THE AMERICAN JOURNAL OF ROENTGENOLOGY AND RADIUM THERAPY

VOL. XXIII JUNE, 1930 No. 6

XANTHOMATOSIS*

(Schüller's Disease; Christian's Syndrome)

A REPORT OF THREE CASES TREATED WITH ROENTGEN RAYS

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XANTHOMATOSIS is the term coined by Rowland[15] to cover a group of diseases in which the lipoid metabolism is at fault. These various diseases had all been considered as separate and distinct clinical entities until Rowland demonstrated that fundamentally they are but different expressions of the same process. He includes the syndrome known as "Defects in the Membranous Bones, Diabetes Insipidus and Exophthalmos"; Gaucher's disease; Pick-Niemann's disease (lipoid histiocytosis); and the various forms of xanthoma, xantho-myeloma and xanthelasma, and considers that they are all the end-results of a process in which the body is unable to handle lipoids normally.

This paper will deal primarily with the first member of the group, but first let us consider the underlying principles as a whole. Rowland believes that these processes start with an excess of lipoid in the body tissues. These lipoids either act upon the vascular endothelium as irritants or upon previously injured surfaces, with the result in either case of lipoid storage in the phagocytic cells of the reticulo-endothelial system. These cells become engorged, reach the refractory stage and thus call forth other cells which in time take up more lipoid, establishing a vicious circle. This lipoid storage may occur in the presence of a hyper-lipoidemia or without it in the presence of infection or trauma. In Gaucher's disease the substance stored in these reticulo-endothelial cells is a lipo-protein; in the Pick-Niemann group, a phosphatid lipoid is in excess, and in the "Defects in the Membranous Bones, etc." group the stored substance is said to be cholesterol. To return to the latter group and in part to use it as an example, the essentials for producing the disease are either a hypercholesterolemia or a normal body fluid cholesterol with traumatized or suppurative areas capable of storing it as a foreign body. The typical and characteristic histological finding is the histiocyte filled with a lipoid, the so-called "foam cell" or "Schaumzelle." This is the finding when the process is active in the tissues, and the probable sequence of events is described by Rowland as follows: "Lipoid and various other substances in excess in the body fluids become pathogenic for the organism. There is at first an irritation of the vessel walls, then perivascular cell infiltration takes place, the lesions increasing as a result of the progressive blockage of the reticulo-endothelial system. At first, small

* From the Department of Roentgenology, Peter Bent Brigham Hospital, Boston, Mass. Read at the Thirtieth Annual Meeting, American Roentgen Ray Society, New York City, Sept. 17–20, 1929.

round lymphoid cells with little protoplasm appear; then, by splitting of the vessel walls, fusiform cells with an abundance of protoplasm develop, and finally, owing to fusion, multinuclear xanthoma cells are formed. These cells show a common vessel endothelial origin and all contain lipoids, the older and more mature cells containing the greater amount. They vary in form and size, but their nuclear structure is similar and they never show karyokinesis. The youngest cells are always in the center of the lesions near the blood vessels and the older and more mature xanthoma cells near the periphery. The xanthoma nodule does not increase by multiplication of its cell elements, but by the addition of new cells." And finally he goes on to say that "the characteristic xanthoma cells are not always observable in the lesions," as the end-result is often a replacement fibrosis leaving peculiar nodular tumors with giant cells and fibroblasts, which may be erroneously interpreted as true neoplasms. Other authors have stressed many of these points but it remained for Rowland to gather them all together and to demonstrate their common origin. Obviously, many of these lesions masquerade in the literature, as Broders[4] says, under various names: sarcoma, myeloid sarcoma, myeloid endothelioma, myeloxanthoma, granuloma, giant cell tumor and giant cell sarcoma. Many instances are quoted by Rowland and the cases reported by Gilmore[8] and Berkheiser[3] are probably cases of this same disease, but are called "myeloma" in both instances.

The syndrome under consideration in this article was first described by Schüller[17] as "Peculiar Skull Defects in Youth" and later[18] as "Dysostosis Hypophysaria." Christian[5] at this hospital described the first case to be reported in this country by the descriptive term of "Defects in Membranous Bones, Diabetes Insipidus and Exophthalmos," and ascribed the disease to a pituitary dysfunction. Hand (1921), Grosh and Stifel (1923), Danzer (1926), and others, reported cases, which with Rowland's 2 cases totalled 14 at the time of his report. In a later article Rowland[16] adds 3 other cases from the literature, which with the cases of Hausman and Bromberg, Globig, and Cignolini now totals 20. I have personally studied 3 other cases which probably belong to this group.

It is important to stress the point that defects in the membranous bones, diabetes insipidus and exophthalmos need not all be present to establish the diagnosis. They are but incidental symptoms or signs of the underlying metabolic deficiency, and any or all may be absent, but from the viewpoint of the roentgenologist the diagnosis is most apt to be suggested by the peculiar irregular motheaten defects in the bones, usually the skull, but also found in the pelvis and occasionally even in the ribs, vertebrae or long bones. The diabetes insipidus is present only if there is a deposit of the cholesterol around the region of the pituitary body or destruction of the bony support of the gland, and the exophthalmos is dependent upon destruction of the roof of the orbit by the process. In fact, one of the most common symptoms and one of the earliest signs is involvement of the teeth and gums in children by an ulcerative inflammatory process classed as gingivitis which results in the loosening of the teeth and sometimes the loss of the tooth or teeth involved. This is found to be due to a deposit of the lipoids at the apex of the tooth, and a pad of this fat-like material usually comes out with the tooth when it is removed. Likewise, jaundice is one of the common symptoms, due to involvement of the Kupffer cells of the liver; cessation or retardation of growth is nearly always present; malnutrition is often a striking general symptom and special symptoms may develop as in Schüller's case* depending upon the localization and extent of these tumor-

* This patient acquired the typical appearance of adiposogenital dystrophy (pituitary insufficiency) probably as the result of long-continued pressure upon the pituitary gland, and this led to the assumption by Schüller that the disease was primarily due to a lesion of the pituitary gland.

like deposits. Aside from the general symptoms of malnutrition and interference with growth in children, the other clinical features are therefore dependent entirely upon: (1) the location of the foreign-body tumor, (2) the size of the deposit and (3) its mechanical effect upon the surrounding structures.

The only finding common to all of the patients in this group is the defects in the bones of the skull, although either diabetes insipidus or exophthalmos or both were present in the large majority. In the children, malnutrition, gingivitis and retardation of growth were strikingly frequent; in the adults this was less common. Obviously there must be patients with this disease who do not show the defects in the skull or the other signs of Christian's triad. In a recent case of Cushing's there was found a localized tumor in the left cerebellar hemisphere which on histological study presented the typical picture of xanthomatosis. Clinically this patient (S 32931) presented only the signs and symptoms of a cerebellar tumor and the preoperative diagnosis was probable tuberculoma. There were no defects in the cranial bones, exophthalmos or diabetes insipidus. Furthermore, the same disease in infants may be entirely visceral, the so-called Niemann-Pick disease. For example, the patient presented by Abrikosoff[1] and later reported by Herzenberg[11] was classed by them as a skeletal form of Niemann-Pick's disease. Ordinarily the visceral type in infants, with marked enlargement of liver and spleen, is rapidly fatal, but as the patients grow older the virulence seems to grow less.

The treatment of this disease is fairly successful, particularly as the disease is liable to spontaneous remissions. Christian's original case, reported in 1918, is alive and well, attending high school and to all outward appearances normal at this writing, twelve years later, although no treatment was successful in alleviating the symptoms at the time the patient was under observation.* On the other hand, Rowland had excellent results in one of his patients by dietary control, giving a diet low in fat, especially cholesterol, and high in green vegetables, together with prophylactic work on the teeth. A third method may be of value in this disease as it is in the allied condition of xanthoma diabeticorum, and that is the liberal use of insulin in addition to regulation of the diet. The fourth method, and the one in which we are particularly interested, is the direct roentgen treatment of the involved areas. This will be considered more in detail after the cases are reported.

The prognosis in xanthomatosis certainly is better than that of malignant neoplasms and probably is fairly good. Of Rowland's collected cases, 7 of the 14 were dead at the time of the report, 2 were known to be alive and well, and the others were alive when reported. It is obvious, of course, that the fatal cases of a strange malady are the ones most apt to be reported in the beginning, and it seems that the more recently reported cases contain many fewer that have died, though of course not very much time has elapsed for them since the onset of the condition.

The final step in the picture is the production of the disease experimentally. While it is obvious that the artificial production of a histological end-result similar to a natural end-result does not mean that the antecedent processes are the same or similar, yet the evidence is too striking to be discarded. Rowland notes the experimental work of Anitschkow and Chalatow[2] who gave diets rich in cholesterol to rabbits and who found transformation of the reticulo-endothelial cells into xanthoma cells, identifying them by vital staining. Subsequent to Rowland's first report, an independent article by Yuasa[20] appeared in which the preceding views as to etiology were still further justified by experimental

* From a study of our records there seems to have been an unusually large number of roentgen examinations made and this may have acted as a mild form of roentgen treatment, as in those days of glass plates the exposures were of fairly long duration.

FIG. 1A. Case 1. Condition of skull on Aug. 30, 1928.

FIG. 1B. Condition on July 17, 1929.

work, using omnivora, to whom cholesterol was not a foreign food.

Our only contributions to the subject are the report of 3 cases, and the discovery of the effect of roentgen rays in therapeutic doses upon the defects in the cranial bones and pelvis and its presumed effect upon the general clinical condition of the patient.

CASE REPORTS

CASE 1. *A possible case of xanthomatosis in an adult, clinically benefited by roentgen treatment.*

Mr. B. S., aged fifty-five, was first seen at this hospital Aug. 30, 1928, at the request of Dr. Albert Evans and Dr. Tracy J. Putman, his complaints being deafness and staggering. (Reference numbers X54034—T. 1673.)

Past History. On March 15, 1913, he was seen by Dr. Evans, at that time complaining of excessive thirst and frequency of micturition. A diagnosis of diabetes insipidus was made. This apparently disappeared spontaneously. A general physical examination April 4, 1922, revealed nothing abnormal. In November, 1924, the patient had a radical mastoid operation on the left side, and at this time a defect was palpated in the parieto-occipital region near the midline. No attention was paid to it and no roentgenograms were taken. Three years ago he noticed soreness in the occipital area. One year ago he had erysipelas involving his right ear and the right side of his face, and his right ear began to discharge; this continued up to the Spring of 1929.

Present Illness. On Aug. 13, 1928, the patient noticed that he was quite deaf and he became "dizzy." He had difficulty in walking in a straight line and began to stagger like a drunken man. He was sent to Dr. Putnam who found the defect in the parieto-occipital area, just to the left of the midline. The defect was about 2×3 cm. in size but was surrounded by a slightly depressed area about the size of one's palm. The general neurological examination was negative except for bilateral elevation of the optic discs of 1–2 diopters. There was no pulsation felt or bruit heard over the defective area. Roentgenograms of the skull showed an area of destruction involving the posterior edges of both parietal bones and the upper edge of the occipital bone (Fig. 1A). The process was purely destructive with no new bone formation or reaction around it. The edges were jagged and irregular. The destruction was more marked in the inner table of the skull. The appearance was thought to be due to metastatic malignancy, in spite of the absence of a palpable tumor to correspond to the defect visible in the roentgenogram, and recourse was had to high voltage roentgen therapy, begun on Sept. 15, 1928, at which time 50 per cent of our maximum suberythema dose was given to the area over the defect in the skull. This dose was repeated two days later. At the next visit

on Nov. 6, it was learned that the deafness had cleared up suddenly three weeks after the treatment, and the dizziness and incoordination were much improved. A second series of two treatments was given to the same area and six weeks later he was in much better condition, although still having some difficulty in walking in a straight line. There were no headaches, nausea or vomiting, the reflexes were active and equal but the Romberg was still positive and the defect was still palpable although apparently smaller. Roentgenograms of the skull confirmed this impression, and showed evidences of healing on the edges of the defect with a cloudy appearance in the center, believed to indicate new bone formation. No further treatments were given until May 1, 1929, when there was clinically a regression in his condition with a return of unsteadiness and of partial deafness. These disappeared after the third and fourth treatments, and on Sept. 5, 1929, he was in excellent condition. After his last treatment (July 20, 1929) he was placed on a limited fat intake and lost 10 pounds in weight. He looked and felt better than he had for years and no further treatments were given. In January, 1930, he complained of pain in his hip, and roentgenograms taken by Dr. Record, of Quincy, revealed an irregular area of destruction in the upper medial corner of the left ilium just above the sacroiliac joint. There was slight reaction in the bone around this area and the bone appeared increased in diameter anteroposteriorly as if due to expansion of a process in the medullary portion. The last roentgenograms of the skull (Fig. 1B) (Jan. 27, 1930) showed a filling in of most of the defect leaving only a pea-sized hole just to the left of the midline.

Discussion. This case is presented as one of xanthomatosis because of its benign character (known duration six years), its association with chronic suppuration in the ear and mastoid, the absence of a palpable tumor to correspond to the defect visible in the roentgen films, the history of diabetes insipidus fifteen years ago, and the association of lesions of similar appearance in the flat bones of the skull and of the pelvis. The response to roentgen treatment was very prompt symptomatically but very slow anatomatically, as judged by the filling in of the defect with new bone. Compared with the two following cases it required sixteen months to obtain as much roentgen evidence of repair in this case as it did in three months in the children. This difference may be due to the difference in ages and the comparatively poor reparative powers of the bone in the adult.

CASE II. *A probable case of xanthomatosis in a boy, aged two and a half years, with healing of the cranial defects under roentgen treatment, recurrence on cessation of the treatment, and remission a second time on resuming roentgen therapy, with coincident improvement of general condition.*

E. T.*, admitted to the Children's Hospital of Boston, Sept. 25, 1928, complaining of sore mouth and gums, excessive thirst and loss of weight, all of six months' duration. (Reference number, A120804.)

Family History. Unimportant.

Feedings. Birth and development were normal. Breast fed one year, then cow's milk, not boiled, with cod-liver oil (for six months only), and orange juice.

Present Illness. In March, 1928 (6 months before admission), the patient's gums became reddened and ulcerated, then he became very thirsty, drinking 5 or 6 glasses of water at a time, and he began to wet his bed frequently (which he still does). His appetite became poor, hoarseness was noted six weeks ago which has gradually increased, and for the past two months he has been fussy and irritable. The stools have been normal.

Physical Examination.

Skin normal

Glands palpable in anterior and posterior cervical, inguinal, and right axillary regions.

Head, eyes and ears normal to inspection and palpation.

Mouth: Alveolar swellings, tender and ulcerated.

Heart and *Lungs* normal.

Abdomen distended, liver edge barely palpable, spleen and kidneys not felt. Marked emaciation present.

Blood. Hb, 60 per cent; white blood count, 12,600; red blood count, 3,800,000; polymorphonuclears, 50–80 per cent; large

*I am indebted to Dr. E. C. Vogt, roentgenologist to the Children's Hospital, for permission to publish this case.

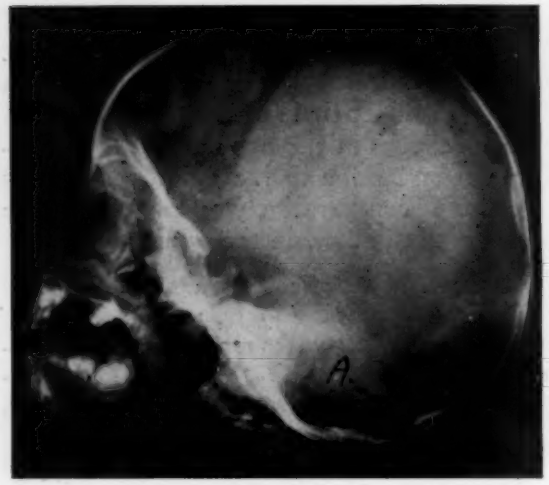


FIG. 2A. Case II. Condition on Sept. 28, 1928, when first seen.

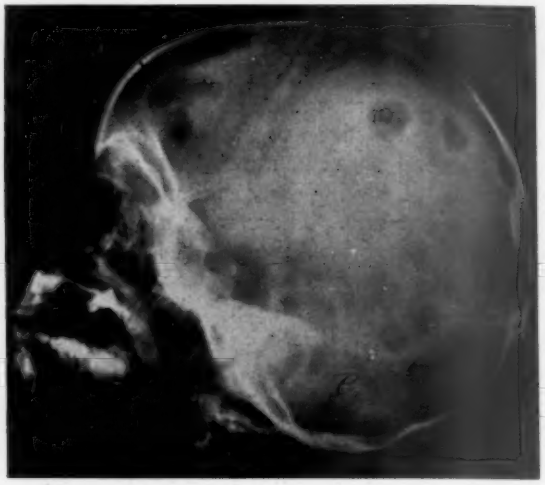


FIG. 2B. Rapid spread of defects in skull by Nov. 16, 1928; no roentgen treatment.

mononuclears, 10–2 per cent; lymphocytes, 40–12 per cent; no abnormal cells.

Urine. 2,300–2,600 c.c. sp. gr. 1000–1004. Intake was limited to 1000 c.c. a day and output was 1380 c.c. sp. gr. 1010. Injections of pituitrin decreased the output to 780 c.c., sp. gr. 1022.

Roentgenograms of the skull (Fig. 2A) revealed several circular defects with sharply outlined ragged edges, some with faintly positive centers. The appearance was thought to be due to syphilis, but the Wassermann reaction was negative and roentgenograms of all other bones were also negative. Myeloma and chloroma were suggested but there was no supporting evidence in careful blood studies and the test for Bence-Jones bodies in the urine gave negative results.

While still under observation the following month, the patient passed several stools containing fresh blood. Cultures were negative for the dysentery bacillus.

Roentgenograms of the skull six weeks after admission demonstrated an increase in the number and size of the defects (Fig. 2B) and at joint ward rounds with the Brigham staff the diagnosis of xanthomatosis was suggested. The blood cholesterol was found to be 185 mg. per 100 c.c.—within normal limits.

Early in November a gland was removed for histological study and a tooth fell out "perched on top of a fat pad". Sections of the gingival tissues were studied histologically and reported as "acute gingivitis" while the gland was reported as a "toxic lymph node."*

Roentgen treatments to the skull were begun on Nov. 7. The child's condition was so poor that a transfusion of 200 c.c. of whole blood was given on Nov. 12, and 200 mg. of sulpharsphenamine was administered. By Nov. 17 the boy was sitting up, taking food with relish, and showing "very considerable improvement" which was attributed to the transfusion. He had gained 2½ pounds in weight, but there was a slight exophthalmos noted, and roentgen examination revealed destruction in the roof of the orbit. Roentgen treatments were repeated and the boy continued to improve in general condition, gaining weight, but the polydipsia and the polyuria with low specific gravity of the urine persisted. The blood choles-

* "*Microscopic.* Sections from the lymph node were stained by the eosin-methylene blue method as well as by the eosin-hematoxylin method. In both cases there is an extremely large amount of strongly basic staining lymphoid tissue in which there are numerous hyperplastic follicles, the centers of which show a considerable amount of toxic reaction. The sinuses in most places are filled with many cells, macrophages and a few multinucleated giant cells which do not stain with Scharlach R. In some places the stroma contains a large number of eosinophiles. There is no stroma increase and the picture is essentially that of a toxic lymph node.

"Several sections from the gingival tissue show an acute inflammatory change in portions of the mucous membrane and subjacent structures. In places an unusually large number of foreign body giant cells are present. Other places show a large number of eosinophiles and many phagocytic cells. The stroma is moderate in amount and in places is rather loosely arranged and shows considerable edema. The picture is that of an acute gingivitis.

"*Diagnosis.* Toxic lymph node; acute gingivitis."

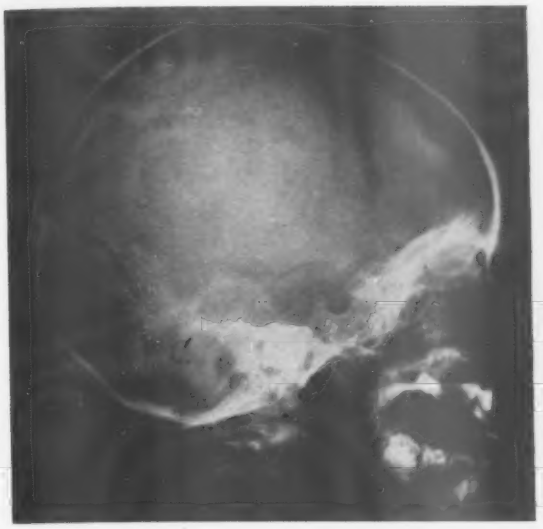


Fig. 2c. Lesions in skull almost healed after four roentgen treatments. Film taken June 18, 1929.

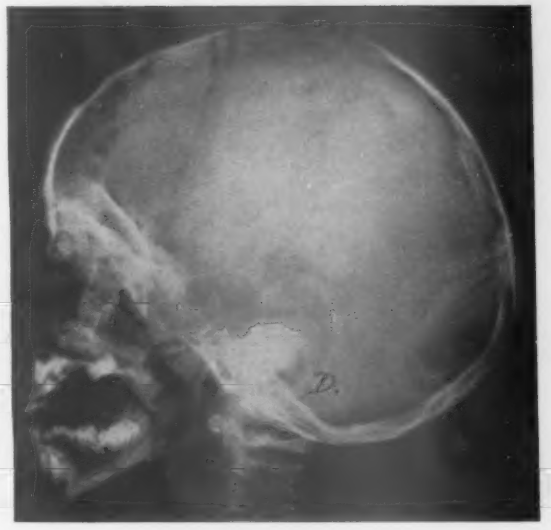


Fig. 2d. New lesions in frontal bone (untreated area) found Sept. 7, 1929.

terol on Dec. 19 was 193 mg. per 100 c.c. A third roentgen examination of the skull on Dec. 21 showed definite healing of the destructive process. Complete epilation was present over the entire skull.

His further course in the hospital was uneventful except for a recurrence of the gingivitis on Jan. 21, 1929, and a mild attack of pneumonia on March 3. He was discharged in fair condition March 16, to be followed in the Out-Patient Dispensary.

The boy was readmitted April 15, 1929, with a second attack of pneumonia. Roentgen examination of the skull at this time showed marked healing of the areas of destruction (Fig. 2c). Blood examination May 10, 1929, revealed, Hb 88 per cent; white blood count, 6,900; red blood count, 5,840,000. Roentgen treatments were continued and on June 4 it was noted that the polydipsia and polyuria were much less marked, and his disposition, which had been irritable, was considerably improved.

The third admission was on Sept. 6, 1929, when he was found to be not so well, irritable, losing weight, pale and emaciated. At this time the exophthalmos was well marked and the diabetes insipidus was essentially unchanged, as he consumed 4 to 7 liters a day. The hair had returned on his head and was normal in color and texture. Roentgenograms of the skull showed a definite irregular area of erosion in the frontal bone. He was discharged after three days and returned Nov. 7, 1929, no treatment having been given in the meantime. Another roentgen examination showed a still further increase in the size of the eroded areas in the skull (Fig. 2d) and roentgen treatments were begun again. By Dec. 11, 1929, there was almost complete epilation except in the mid-frontal area which was then treated. By Feb. 19, 1930, roentgenograms showed definite new bone filling in the defective areas, but the sutures were slightly separated indicating increased intracranial pressure. Clinically he was much improved, drinking less, urinating less, and the record states that his condition was the best seen since first admission.

When last seen, April 18, 1930, he was well, his hair was returning after the second epilation, but roentgenograms showed new areas of destruction in the left mastoid region and in the mandibles and maxillae, particularly in the molar regions. These areas had not received roentgen treatments.

A summary of his roentgen treatments all given at 40 cm. target skin distance, using 120 kv., 4 ma., and 15 minutes each, through 4 mm. aluminum filter is as follows:

Date	Area
Nov. 5, 1928	Entire right side of skull
Nov. 7, 1928	Entire left side of skull
Dec. 4, 1928	Entire left side of skull
Dec. 5, 1928	Entire right side of skull

FIG. 3A. Case II. Photograph of patient on first admission, Sept. 28, 1928.

FIG. 3B. Photograph on July 22, 1929.

Date	Area
Jan. 17, 1929	Entire right side of skull
Jan. 18, 1929	Entire left side of skull
Mar. 4, 1929	Entire chest
Mar. 12, 1929	Entire right side of skull
May 8, 1929	Entire left side of skull
May 10, 1929	Entire right side of skull
June 5, 1929	Chest, anteriorly
July 12, 1929	Chest, anteriorly

Discussion. This two and a half year old boy had the diabetes insipidus, defects in the membranous bones and exophthalmos, which characterized Schüller's and Christian's cases, and in addition had the ulcerative gingivitis, emaciation and anemia which Rowland has added to the picture. His lungs showed increased hilus shadows and faint mottling of the lung fields which Rowland has also described, all of these in favor of the diagnosis. Against it we have: (*a*) the report of the biopsy of a cervical gland which did not show the picture described by Rowland; (*b*) the circular multiple defects in the skull not of the "map-like" destruction shown in Schüller's and Christian's cases, and (*c*) the slight degree of exophthalmos. Finally, if I am correct, there is in favor of the diagnosis of xanthomatosis the characteristic response to roentgen therapy, by healing of the areas of destruction treated by the roentgen ray, while in the untreated areas new foci of destruction appeared. A comparison of his photographs (Figs. 3A and 3B) gives the best evidence of his clinical improvement. The enlarged cervical glands could be explained by the gingivitis, and the "fat-pad" noted in the history apparently did not reach the department of pathology.

CASE III. *A presumed case of xanthomatosis in a boy of four and a half years, markedly benefited by roentgen treatment, recurrence on cessation of treatments in spite of low fat diet and insulin and second remission with roentgen treatments.*

R.M., aged four and a half, was first seen March 1, 1928, at the request of Dr. Horrax. His complaint was a swelling of the right forehead, and prominence of the right eye of six months' duration. (Reference numbers. M. 33109; X51194; T. 1558.)

Ancestry. English and Irish.

Feeding. Birth and development normal, feeding history not unusual or abnormal.

Past History. Has had rubella and varicella without complications. Best weight 39½ pounds. No gain in weight for past year.

Fig. 4A. Case III. Photograph of patient on Oct. 22, 1928. Note depression of right eyeball as well as exophthalmos.

Fig. 4B. Photograph on July 22, 1929.

Present Illness. Six months ago he fell, striking his right forehead. There was slight swelling afterward which persisted, and a month later his right eye became prominent. Tight bandages reduced the swelling on the forehead, but after removal of the bandages the swelling recurred. He was taken to an eye specialist who found nothing abnormal except the exophthalmos. Roentgenograms were made of the sinuses which revealed extensive defects in the bones, and he was referred to Dr. Horrax at this hospital.

Physical Examination. There was diffuse swelling over the right forehead and temporofrontal region with a soft area palpable over the right eye. Pulsations could be seen and felt and a faint blowing bruit could be heard in and over this area. There was no tenderness. The area was considered to be a defect in the bone as a hard irregular edge could be felt around a central soft spot 2×3 cm. in size. The fundi were normal. There were no sensory, motor or reflex changes elicited (Dr. Horrax).

Roentgenograms of the skull (Fig. 5A) revealed several large irregular defects in the right frontal bone, the largest one 5×5 cm. in size. There was also destruction of the roof of the right orbit and a smaller similar area of destruction anteriorly in the left parietal bone.

In the absence of diabetes insipidus, which at that time we thought to be an essential part of the clinical picture of Schüller's disease, we considered the process to be malignant and instituted roentgen therapy, giving two doses, each one-third of an erythema dose, two days apart, both over an area 10×10 cm. in size, centered on the defect in the right frontal bone. Six weeks later he was re-examined and the roentgenograms of his skull showed evidences of healing (new bone formation and a loss of the distinct edge to the areas of destruction) in the right frontal area which had received the roentgen treatment, while the area in the left parietal bone had grown larger (Fig. 5B). Another roentgen treatment was given to the same area, using the same dose, but with seven days between the two doses. The third series of treatments was given over the left parietal defect, using the same factors, but giving 42 per cent of an erythema dose at each of two sittings one week apart. All of the treatments given to this boy and to Case I were with 185

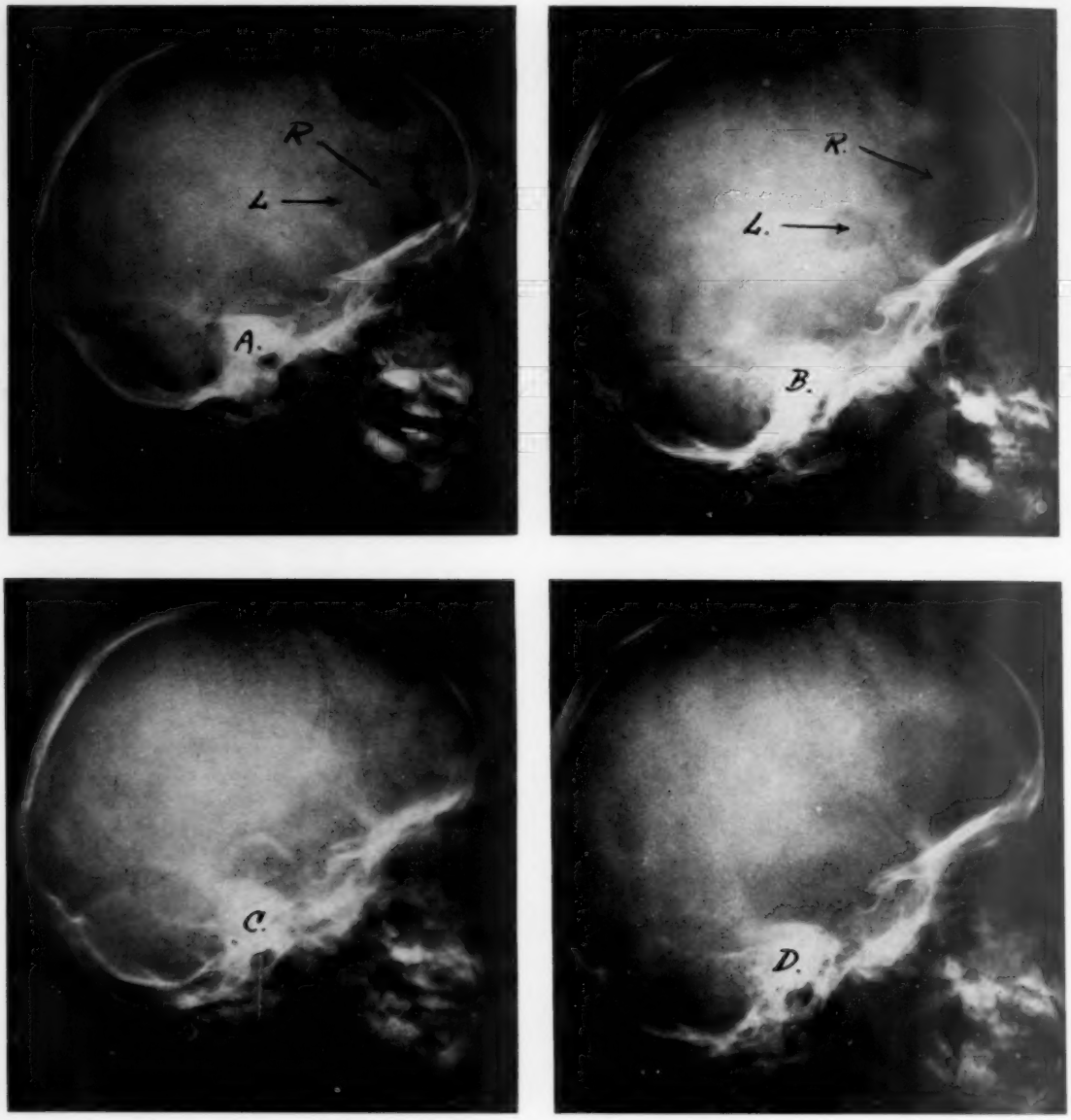


Fig. 5. Case III. Lateral views of the skull to demonstrate (A) original condition found on March 1, 1928; (B) beginning healing of the right frontal defect (R) two months after roentgen treatment and enlargement of left parietal defect (L) which had not been treated, May 31, 1928; (C) healing of both defects five months later, Oct. 22, 1928; (D) recurrence in spite of low fat diet and insulin, Feb. 1, 1929.

kv., 40 cm. target skin distance, a filter of 0.5 mm. of rolled copper plus 1 mm. aluminum, portals 10×10 cm., except the pelvis which was 15×15 cm. in size. With these factors we have found our maximum suberythema dose to be 240 milliampere-minutes, or 760 r measured by the Duane ionization chamber in air. The third examination after a two months' interval showed continued healing on the right and beginning healing on the left (Fig. 5C).

At this time we learned from Dr. Christian of Rowland's as yet unpublished work on xanthomatosis, correlating this disease with a deficiency in the utilization or storage of fat. As all of the visible defects were healing (the rest of the bony skeleton showing nothing sugges-

tive at that time), we instructed the boy's mother to keep him on a low fat diet, confidently expecting a permanent suppression of the destructive process in the bones. On Aug. 9, 1928, he was admitted to the medical ward for more complete study. Physical examination revealed carious teeth and several empty sockets, no glandular enlargement, liver and spleen not palpable, lungs and heart normal, right testicle not present in scrotum. The laboratory findings were: Blood Wassermann and Hinton tests negative, blood urea nitrogen 10 mg., blood sugar (fasting) 0.08 per cent, blood cholesterol (digitonin method) 84 mg. per 100 c.c., icteric index 4. The basal metabolic rate was +1. The urine varied from 200 to 650 c.c. at each urination, sp. gr. 1006 to 1024; sugar 0; albumin 0. On Aug. 14, the blood urea nitrogen was 10 mg. and the blood cholesterol after twenty-four hours of high fat diet was 120 mg. per 100 c.c. The stools showed nothing abnormal.

The boy was discharged Aug. 16 on a diet of 300 gm. carbohydrate, 70 gm. of protein and 70 gm. of fat, totaling 2200 calories, with instructions to avoid cholesterol-containing foods such as egg yolk, cream, butter, brains and sweetbreads. He was followed as an outpatient and Dr. William P. Murphy did further blood studies as noted below. In spite of his low fat diet a roentgen examination on Sept. 18, 1928, revealed a new area of destruction in the posteromedial corner of the left parietal bone. This was not treated by roentgen radiation and six weeks later the area had increased slightly in size. After three months of low fat diet the roentgenograms of the skull showed a definite increase in the size of this lesion as well as a reabsorption of the bone in the right frontal area where healing had taken place (Fig. 5D).

Accordingly he was readmitted to the hospital on Feb. 19, 1929, for further study. It was found that the right eye was more prominent than before with a soft fluctuant swelling just to the right of the eyebrow and spreading back over the temporal area. He was drinking more frequently but not in unusual amounts. There had been no gain in weight. He was anemic, the red blood count being 4,580,000, Hb 50 per cent, white blood count 6,400. The differential count was: polymorphonuclears, 67 per cent; lymphocytes, 28 per cent; monocytes, 4 per cent; eosinophiles, 1 per cent. Blood cholesterol was 129 mg. per 100 c.c., and blood sugar 0.08 per cent. On Feb. 22, 1929, insulin was started to improve the appetite and thereby improve the anemia, to add weight and to note the effect on the disease, particularly as evidenced by the defects in the cranial bones. On Feb. 28, the blood cholesterol was 160 mg. per 100 c.c. He was discharged on a low fat diet and in addition was getting 5 units of insulin twice a day. Reexamined a month later, the roentgenograms revealed a slight further increase in the size of the right frontal defect and another series of roentgen treatments was given to this area with $\frac{1}{3}$ of an erythema dose at each of two sittings a week apart. Two months later (the patient receiving 10 units of insulin daily in the interval) there were again signs of healing in the right frontal area while the left parietal lesion had increased in size and now appeared multilocular (Fig. 6C). Another two months' interval without roentgen treatment but with diet and insulin as before was allowed to pass and the roentgenograms showed continued healing in the treated frontal area, and a further increase in the size of the parietal lesion (Fig. 6D). In September, 1929, another survey of his skeleton revealed a bilocular area of destruction in the wing of the left ilium in the region of the nutrient artery channel. This area was treated Sept. 10 and 12, each treatment being $\frac{1}{3}$ of an erythema dose. In six weeks there was only slight evidence of repair but after six more weeks the lesion was almost entirely healed. At the former time (Oct. 29) the lesion in the left parietal area, having increased to considerable size by this time and having served as a control for spontaneous remissions or systemic effects, was treated by roentgen rays, using two doses, each $\frac{1}{3}$ of an erythema dose, on successive days. Six weeks later (Fig. 6E) there was beginning healing, and by Jan. 25, 1930, the area was considerably clouded by the new bone formation. At his last examination (April 28, 1930) the area was barely distinguishable from the normal bone around it (Fig. 6F). At the same examination, films of his pelvis showed complete healing of the lesion in the left ilium, but there was a new area quite symmetrically placed in the right ilium. There were also new defects in the long bones which had up to this time been normal,—small round holes 2 cm. in diameter, one in each femur and one in the lower third of the right humerus. Surrounding

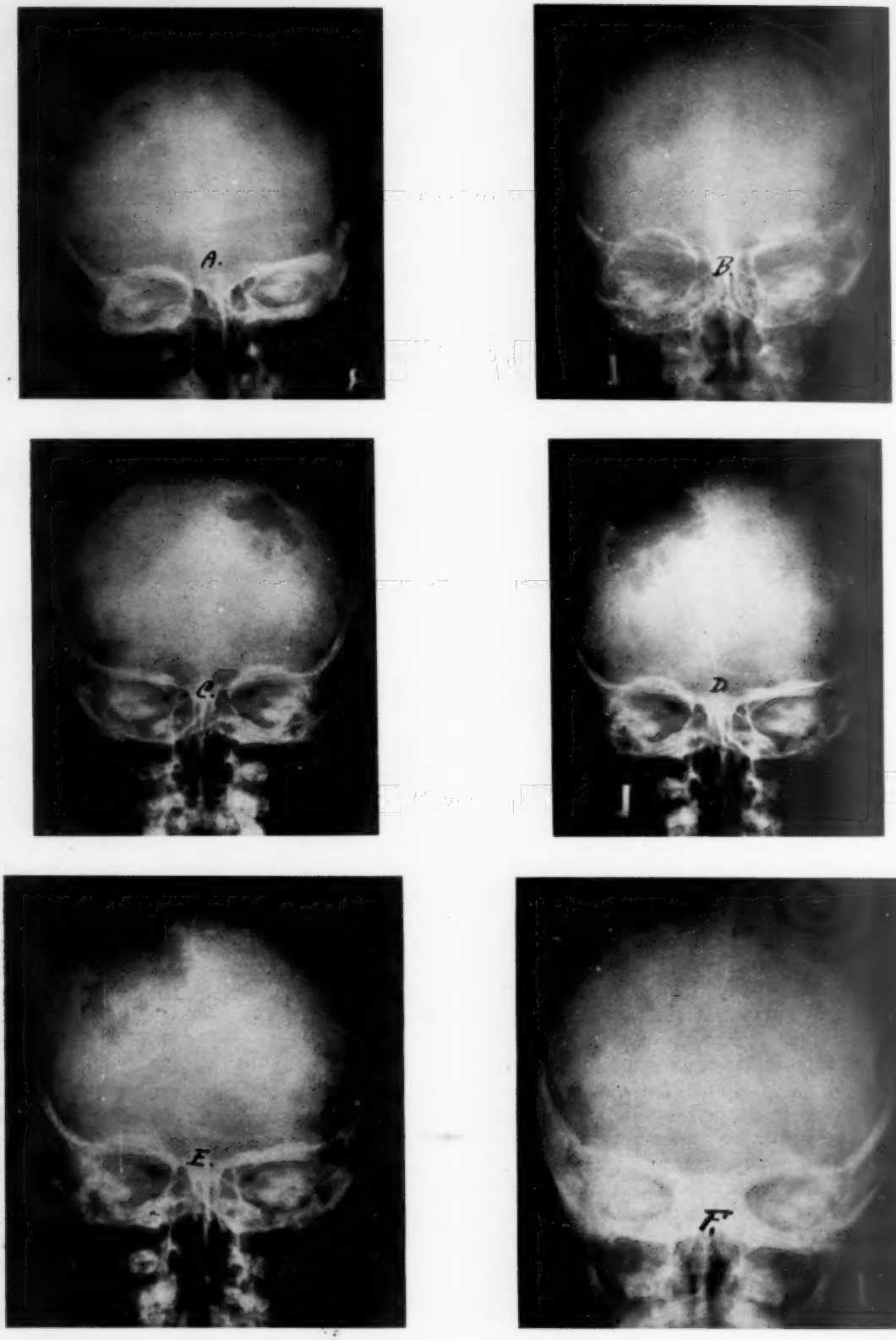


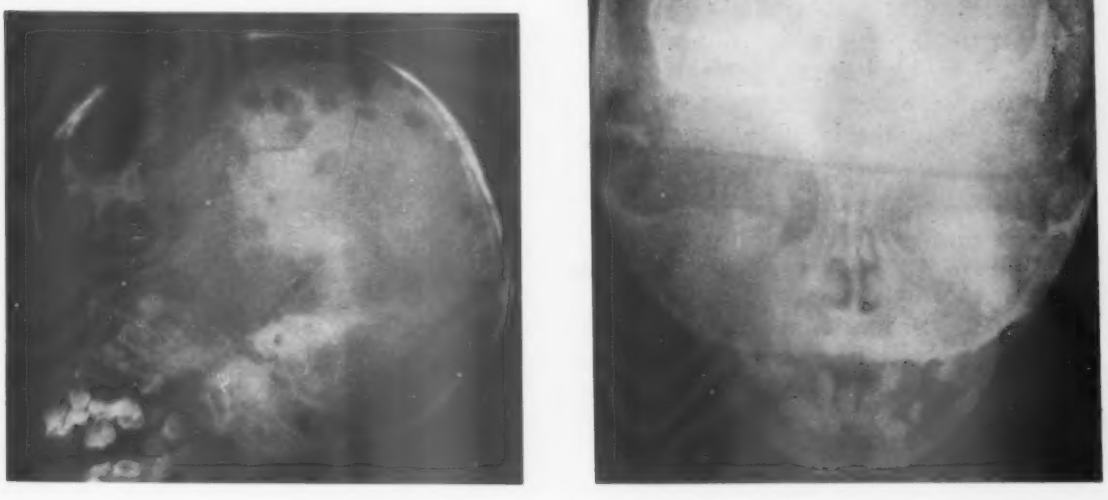
FIG. 6. Case III. Anteroposterior views of the skull to demonstrate continuous enlargement of the left posterior parietal defect without roentgen treatment. (A) Condition on Oct. 22, 1928; (B) Feb. 1, 1929; (C) July 22, 1929 (print reversed); (D) Oct. 26, 1929; at this time roentgen treatment was given to this area; (E) Dec. 11, 1928, eight weeks after roentgen treatment, 2/3 erythema dose, not repeated; (F) continued healing (April 28, 1930), no further roentgen treatment.

the ones in the femora there was localized thickening of the cortical bone apparently from the periosteum which appeared raised. There was no reaction around the defect in the humerus. His chest by roentgen examination as well as by physical examination has remained normal throughout, with only a moderate exaggeration of the hilus shadows, not sufficient to indicate a definite abnormality. There were single very small areas of destruction on the edge of the old frontal defect, one in the mandible and one on the medial end of the right petrous ridge.

It should be noted that in January and February the patient had a severe attack of pertussis which set him back considerably. His weight at last examination was 47 pounds.

His physical age as judged by the development of the epiphyses and other centers of ossification is five and a half years, his actual age now is six and a half years, a definite retardation in development. Except as noted above, the boy appears well nourished, well developed and well proportioned. He is active and energetic, playing normally and attending school, and is alert mentally. A transcript of Dr. Murphy's records shows his weight to have increased from 37 pounds when first seen to 47 pounds at the last visit, with a maximum of 52 pounds on Dec. 12, 1929, before a severe attack of whooping cough. His blood cholesterol (Bloor's modified method) has varied from 84 mg. per 100 c.c. to 213 mg. per 100 c.c. in thirteen examinations, being highest in January, 1929, and 109 mg. per 100 c.c. at his last visit. The blood sugar on eight examinations varied from 0.076 to 0.125, the latter being his last specimen. Hemoglobin, twelve examinations, varied from 59 per cent (S) to 86 per cent (S), red blood count 4,390,000 to 5,190,000, white blood count 5,000 to 9,000, with no abnormal cells and normal ratios of the various elements, e.g., polymorphonuclears, 53 per cent; eosinophiles, 2 per cent; basophiles, 2 per cent; lymphocytes, 28 per cent; large lymphocytes, 6 per cent; monocytes, 9 per cent. The blood calcium was 12.5 on three examinations, and blood urea nitrogen 10 and 11 on two tests. Our next step is to try the effect of feeding desiccated thyroid gland, as noted by Rowland in his Case 2. If successful, this will be reported later. For prognosis see below.

Discussion. This case affords undoubted evidence that the lesions in the bones are directly and favorably influenced by roentgen treatment, as on three separate occasions the lesion treated with roentgen rays healed, while others untreated continued to enlarge. Low fat diet in this case, as in our



A B

Fig. 7. Christian's original case, from plates made March 27, 1918. Patient's father refuses any further examination (see text for condition of patient). (A) Lateral view. (B) Posteroanterior view.

Case II, did not prevent or stop the development of other lesions. Insulin in doses of 10 units a day over several months also had no effect on the defects in the bones, although it may have improved his blood, hemoglobin and general condition.

As to the diagnosis, there is no doubt in the minds of those acquainted with this disease that this is a true case of the syndrome described by Rowland, although it has not been confirmed histologically. If a biopsy of one of the treated areas were done, the histological picture would no doubt be very confusing, as it is when similar biopsies are done on lymphoblastoma nodules which have undergone irradiation. As yet there has been no justification for a biopsy.

DIAGNOSIS

To roentgenologists the most important point in the diagnosis is the presence of the defects in the skull or pelvis or both, occasionally in other bones. When characteristic they involve the inner table of the skull more than the outer table, have distinct, clean-cut, but irregular edges, and often present the map-like or geographical ("Landkartartige") appearance described by Schüller. They may, however, simulate metastases or syphilis, but an important differential point here is the absence of a palpable tumor of any size comparable to the defect visible in the roentgenogram, or of the consistency of other tumors. When present the tumor is of the nature of a soft swelling over the involved area; more frequently there is a depression or defect palpable as well as visible, but smaller to palpation, indicating the lesser degree of involvement of the outer table of the skull. The diabetes insipidus and exophthalmos, at first thought to be essential to the diagnostic triad, are but accidents due to the location of the pseudo-tumors respectively (*a*) around the pituitary body or tuber cinereum, (*b*) in the roof of the orbit. Of more importance are the history of preceding trauma or infection, the cessation of growth and lack of gain in weight, the malnutrition and anemia, and the frequent gingivitis and occasional jaundice. The histological picture is quite variable depending upon the stage of the disease, and only in the active growing lesions are the typical fat-laden xanthoma cells (foam cells, Schaumzellen) visible. Several cases have been reported as myeloma or other neoplasms, as Rowland points out, and in addition to his cases I have found another case report by Globig[9] in which the clinical history, roentgen, physical and operative findings are quite typical. The foam cells are described carefully and accurately ("the cells contain double-polarizing lipoid, like xanthoma cells"), but his final diagnosis is myeloma.

TREATMENT

Spontaneous remissions undoubtedly occur in this disease, as Christian's original case is alive and well in 1930, twelve years after the disease was noted, and then in an advanced stage. Recently Lyon and Marum[13] reported that one of Schüller's cases, first reported in 1913, was still alive in 1929, in improved general condition, with the defects in the skull almost gone, but with the diabetes insipidus and exophthalmos still present. It is interesting to note in this case that during a period of defective vision in one eye there were visible by ophthalmoscope "several yellowish-white small foci in the region of the macula," probably deposits of cholesterol or lipoids and suggesting that the disease is still active in this patient.

In addition to spontaneous remissions, Rowland has demonstrated that an active remission may follow a low fat diet, with a fall in the blood cholesterol, at least in one case. He complicated the picture, however, by feeding desiccated thyroid and anterior lobe of pituitary, and the endocrinologists might consider this to be the more important part of the treatment. In our Case III, there was no improvement on a low fat diet; on the contrary, the defects in the

skull grew larger during the time the patient was on this diet.

A third method of treatment has been suggested, in view of the good results obtained in xanthoma diabeticorum, and that is the use of insulin and a high caloric diet. This also failed in our Case III, who received twice daily doses of insulin, 10 units, with no improvement except in appetite, but on the contrary, a steady increase in the size of the defects in the cranial bones. Ingram[12] also denies the efficacy of insulin in the cutaneous xanthomas of diabetic patients. Other forms of glandular therapy have been attempted; for instance, Rowland used desiccated thyroid in his case combined with the low fat diet. He also gave pituitary (anterior lobe) by mouth. The former might account for the improvement, the latter would probably be entirely destroyed in the stomach and of no importance. Hausman and Bromberg[10] fed parathyroid extract to their patient without benefit, and Christian[6] notes that various forms of pituitary extract and pituitary substance by several methods of administration had no effect upon the defects in the skull of his patient over a period of six months, although the diabetes insipidus was controlled when the substance was injected subcutaneously.

A fourth possible method of treatment is the ultraviolet radiation of the patient or his food or both. The former has been tried by Hausman and Bromberg with no benefit. Their patient also failed to improve on a high calcium diet with parathyroid and cod-liver oil administered orally. Injections of pituitrin, however, controlled the diabetes insipidus as it has in other cases.

The fifth method of treatment affects the local deposits primarily, but permits general improvement and has proved to be efficacious for the secondary results of the disease such as the diabetes insipidus and the exophthalmos. This method is roentgen treatment of the lesions, begun by us in 1928, also reported independently by Cignolini,[7] Gilmore,[8] and Radding.*

PROGNOSIS

Obviously the prognosis is much better than in neoplasms as the survivals previously noted (twelve years in Christian's patient, sixteen years in Schüller's patient) far exceed that of any malignant tumor with which this disease might be confused. Our Case I may well have had this disease in 1913, a possible duration of seventeen years. The problem of curing the disease, apparently solved by Rowland in his Case 2, is still of moment as our Cases II and III did not respond to the etiologically indicated low fat diet. Of Rowland's 14 cases reported in 1928, 7 were dead of the disease while as far as known, the other 7 were living. Of the 9 cases collected since then, including our own, 7 are alive as far as known at present. The rarity of this disease in adults and the spontaneous remissions in the cases surviving the childhood stage would suggest that either a tolerance is acquired or that the provocative lesion heals or disappears. Therefore, if we can tide over the severe early stages we may expect either a remission or a decrease in the severity of the disease with a coincidental improvement in the outlook. As a palliative, locally very effective measure, roentgen treatments seem to be of prime importance.

ETIOLOGY

It is almost useless to speculate as to the exact cause of the disease or as to its mechanism. That there is a disturbance of fat metabolism there can be no doubt. Raab[14] has recently published some very interesting work on the central (nervous) control of fat metabolism, which, he says, is initiated in the pituitary gland and relayed by the vegetative centers in the floor of the third ventricle and hypothalamus to the sympathetic system, which in turn acts both as a mobilizer of stored fats and also

* Personal communication. Dr. Radding states that he saw a patient with this same disease in June, 1923, and gave roentgen treatments to the skull. This patient is said to be alive and well in September, 1929, the defects having healed. A complete report of the case has been promised by Dr. Radding.

effects the destruction of excess lipoids in the liver. The early writers thought that this disease was due to a pituitary lesion; Rowland thinks the pituitary syndrome is secondary. The tendency of the day is to find more and more functions centered in the small region in and behind the floor of the third ventricle, and the pendulum may swing back to this point rather than to the pituitary gland as the primary cause of the disturbance of fat metabolism. The exact rôle of cholesterol is also questioned, as Wile and his coworkers[19] have shown by careful tissue analysis that the cutaneous xanthomata do not contain more cholesterol than does normal skin, but the excess fat deposit is due to other lipids than cholesterol.*

One of their patients was a diabetic with cutaneous xanthomata, and in this patient an increase in carbohydrates was followed by an increase in the size of the tumors, while a decrease in carbohydrates with an increase in ingested fats was followed by a decrease in the size of the tumors. In their other two patients a high fat diet did not cause an increase in the size of the tumors while in one of them, an obese patient, a "reduction diet" caused a decrease in the size of the visible xanthomata. They conclude that xanthomata are the result of an abnormal fat metabolism, but not the result of a hypercholesterolemia.

Whatever the primary cause of the disease may prove to be, there is no doubt that the condition is a definite clinical entity and that in all probability a disturbance in the metabolism or storage of fats is the immediate cause of the clinical syndrome as we see it.

* Their analyses of the tumors showed that cholesterol accounted for 15 per cent of the entire lipids, and 2 per cent of the solid content of the tumors.

SUMMARY

Three cases of xanthomatosis are reported. This disease is presumably due to a disordered metabolism of fats but its primary cause is unknown. Regulation of diet did not cause any reparative changes in the cranial defects in two of the cases. Insulin was similarly of no help in one case. All three patients were benefited by roentgen treatment and the defects in the skull underwent healing changes in each case. Three other cases are collected from the literature, making a total of 23 assembled to date.*

* For discussion see page 628.

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INDIRECT SIGNS OF BRAIN TUMOR AS NOTED IN ROUTINE ROENTGEN EXAMINATIONS

DISPLACEMENT OF THE PINEAL SHADOW*

(A Survey of 3000 Consecutive Skull Examinations)

By CORNELIUS G. DYKE, M.D.

NEW YORK CITY

A REVIEW of approximately three thousand roentgenograms of the skull was undertaken to ascertain the value of measuring the position of the pineal shadow and noting this position in relation to a previously established normal zone. In addition, certain uncommon findings in skull roentgenograms were noted in an attempt to determine their relative frequency. Of the entire series of roentgenograms 2724

CHART SHOWING THE FREQUENCY OF CERTAIN FINDINGS WITHIN THE SKULL IN DECADES

Age:	1–10		11–20		21–30		31–40		41–50		51–60		61–70		71–80		over 80		Total Males	Total Females	Total
Sex:	M	F	M	F	M	F	M	F	M	F	M	F	M	F	M	F	M	F			
Number of Patients	108	68	203	167	245	239	285	295	267	230	214	205	87	78	20	12		2	1429 52%	1295	2724
Calcification in Choroid Plexus		2	4	1	6	4	17	9	22	13	21	14	15	6	4	2			89	51	140 5.1%
Normal Spicule Formation	5	2	21	18	18	17	12	9	5	2	2	1	1		1				65	49	114 4.5%
Calc. in Internal Carotid Artery					1		1	1	1	2	9	9	4	6	1	2			17	20	37 1.3%
Thickened Irregular Frontal Bone		1	3	4	5	7	3	22	4	16	2	18		16	1	1			18	85	108 3.7%
Calc. in Falx	1	1	8	4	20	13	23	24	23	19	25	15	6	9	3				104	85	189 6.9%
Bridged Clinoids			7	5	5	8	8	7	9	5	1	5	1	1	1				34	31	65 2.3%
Number of Calcified Pineal Glands	4	5	56	48	131	104	182	170	179	129	153	125	58	48	14	8		2	777	639	1416 51%

CHART 1. Distribution, as regards sex and age in decades and the relative frequency of aforesaid findings seen in skull roentgenograms. (The percentages are based on the total number of patients examined.)

* From the Departments of Surgery and Roentgenology, Peter Bent Brigham Hospital, Boston, Mass. Read at the Thirtieth Annual Meeting, American Roentgen Ray Society, New York City, Sept. 17–20, 1929.

were found to be satisfactory for this study. The findings which were noted principally for statistical purposes are as follows:

1. The frequency of calcification within the pineal gland.
2. The frequency of displacement of the pineal gland by brain tumors.
3. The frequency of calcification in one or both internal carotid arteries.
4. The frequency of thickening and irregularity of the inner table of the frontal bones, the so-called "senile hyperostosis."
5. The frequency of calcification in the falx.
6. The frequency of bridging of the clinoid processes.
7. The frequency of the normal perpendicular bone formation in the outer table of the skull usually noted in the parietal region.
8. The frequency of calcified areas within the choroid plexus.

In Chart 1 a report of the relative frequency of these various findings is arranged according to the age in decades, and the number of each sex showing these changes is also given.

Fig. 1. Showing the thickening and irregularity of the inner table of the frontal bones.

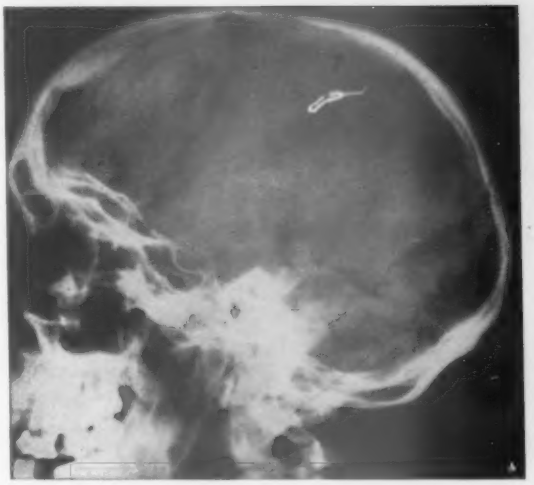

Fig. 2. Showing the perpendicular laying down of bone in the outer table of the skull in the parietal area.

Of the total of 2724 patients, 1429, or 52 per cent, were males and 1295, or 48 per cent, were females. A study of Chart 1 shows that sex apparently has a definite relation to the frequency of occurrences of thickening and irregularity of the inner table of the frontal bones (Fig. 1), for this abnormality was noted in 85 females and in only 18 males, or, in other words, it is almost five times as frequent in females as in males. This we cannot explain at the present time but a further study is in progress to determine whether or not there is a common factor in its production (to be reported later).

Another finding which shows an evident unequal distribution is the perpendicular laying down of bone in the outer table of the skull, usually noted in the parietal region (Fig. 2). Of the 114 cases recorded, 81, or 70 per cent, occurred in patients under thirty years of age. It may be added that this age group represented only 37 per cent of the total number of cases examined, i.e., 1030. The significance of this is as yet uncertain, but it seems not at all improbable that it may represent an attempt on the part of the organism to rapidly increase the size of the cranial vault rather

than a manifestation of disease, although, as is well known, spicule formation is quite frequent in the sarcomas arising in bone and also in the skull as a reaction to underlying tumors such as meningiomas or to the congenital anemias of children (Chart I).

Before discussing the significance of displacement of the pineal shadow it is well to observe that the pineal gland was visible in 1416 cases, or 51 per cent of the total number, and that it was noted in 59 per cent of the patients who were over twenty years of age.

It is interesting that Schüller,[2] in a footnote, remarks on the frequency of calcification of the pineal as follows: "The pineal gland very often shows a calcium deposit in young individuals from about the third decade, and occasionally even in children." In the present series calcification occurred in 5.1 per cent of the cases of children under ten years of age, and it is our impression that it is no more frequent in patients with craniopharyngiomas. Moreover, there is no evidence that calcification of the pineal gland has any relation to the frequency of calcification in the choroid plexus.

The main purpose of this study was to determine if possible the exact significance of displacement of the pineal shadow. Schüller was probably the first to call attention to the value of noting the position of the pineal shadow, and he cites a case of a patient suffering from a hemiplegia of the *right* side following an apoplectic stroke, with a history of a traumatic injury of the skull two years previously. The roentgenograms showed the pineal gland displaced several millimeters to the *left* of the midline, and Schüller concludes that "no large tumor of the left hemisphere could be the cause of the hemiplegia, but rather that there was probably a contraction present, perhaps in consequence of an area of softening." However two cases in our series have had large cerebral tumors with displacement of the pineal shadow to the same side.

Naffziger[1] reported one verified case in which the pineal was displaced toward the side of the skull opposite the tumor. Vastine and Kinney[3] working at the Peter

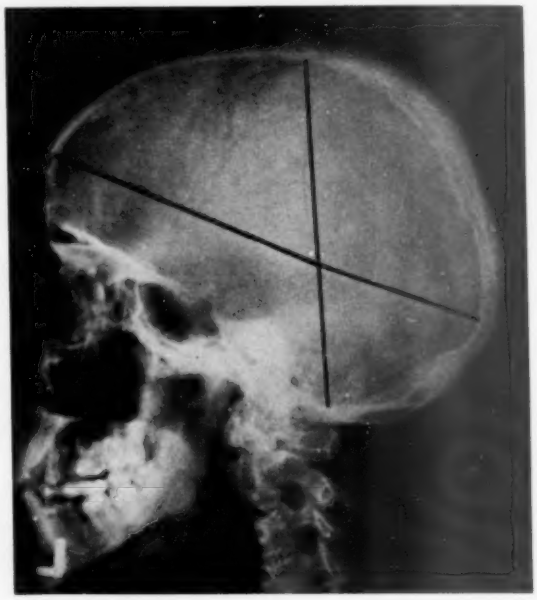

FIG. 3. Showing the points on the skull from which the measurements are taken to determine the location of the pineal gland.

Bent Brigham Hospital devised a method whereby the position of the pineal gland could be measured and displacement of the gland anteriorly, posteriorly or vertically could be ascertained. These authors first established a normal zone by taking measurements of 200 skull films of patients in whom there was no evidence of intracranial disease or neoplasm.

According to Vastine and Kinney's method, measurements were taken as shown in Figure 3 *from* the pineal gland to:

(1) The inner table of the frontal bone at its most distant point.

(2) The inner table of the occiput at its most distant point.

(3) The inner table of the vault.

(4) The inner table of the cerebellar fossa.

In Chart II the measurement of the distance from the pineal gland to the inner

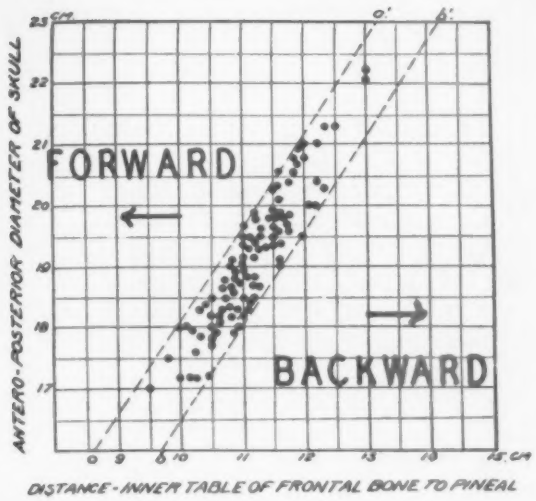

Chart II. The measurements of the distance from the pineal gland to the inner table of the frontal bone was plotted against the sum of the distances from the pineal shadow to the frontal bone and to the occiput—this sum is approximately equal to the greatest anteroposterior diameter of the skull. The pineal glands of normal skulls were found to lie between the lines $a-a'$ and $b-b'$ which was considered the normal anteroposterior variation in position. (Reproduced from the article by Vastine and Kinney.)

table of the frontal bone was plotted against the sum of the distances from the pineal shadow to the frontal bone and to the occiput. This sum is approximately equal to the greatest anteroposterior diameter of the skull. The pineal glands of normal skulls were found to lie between the lines a-a' and b-b', which was considered the normal anteroposterior variation in position.

In Chart III the measurement from the pineal gland to the inner table of the vault was plotted against the sum of the distances from the pineal gland to the inner table of the vault and to the inner table of the cerebellar fossa—this sum is approximately equal to the vertical diameter of the skull. The pineal glands of normal skulls were found to lie between the lines $c-c'$ and $d-d'$, which was considered the normal vertical variation in position (Charts II and III).

Having thus established a normal range, it was considered that any pineal shadow lying to the left of the line $a-a'$ was displaced anteriorly, and to the right of $b-b'$ was displaced posteriorly, and any pineal shadow lying above the line $c-c'$ was displaced upward and any below the line $d-d'$ was displaced downward.*

In this series of 2724 roentgenograms of the skull, there were 494 cases of verified intracranial tumors. Of this number, 253 had a visible pineal, and 99, or 39 per cent, of these were found to be displaced. In the series of 212 gliomas, 94 had a visible pineal shadow and of this number 53, or 56.3 per cent, were found to be displaced. Of the 75 meningiomas, 48 had visible pineals, 21, or 43.7 per cent, being displaced. Of 91 pituitary tumors

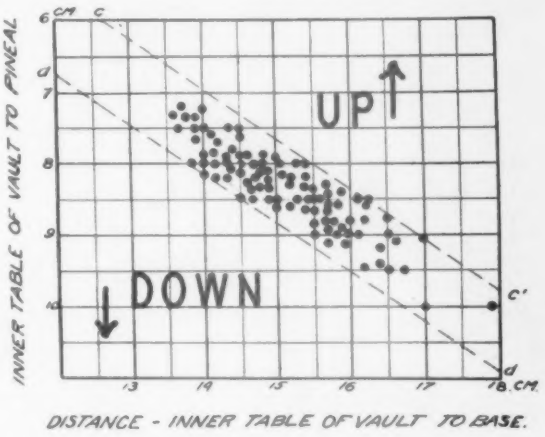

Chart III. The measurement from the pineal gland to the inner table of the vault was plotted against the sum of the distances from the pineal gland to the inner table of the vault and to the level of the base of the skull—this sum is approximately equal to the vertical diameter of the skull. The pineal glands of normal skulls were found to lie between the lines $c-c'$ and $d-d'$ which was considered the normal vertical variation in position. (Reproduced from the article by Vastine and Kinney.)

* These skull films were all taken in standard positions, 36 inch target-film distance, prone or supine, and with the focal spot directly over the sella. It is quite essential to have anteroposterior or posteroanterior films exactly straight in order to be sure of a lateral shift of the pineal shadow. Minor degrees of rotation on the lateral films are of less importance in the measurements, but for accurate measurements the films should show the floors of both frontal fossae superimposed and the descending rami of the jaws also superimposed on each other.

TABLE I

Type	Total Cases	Visible Pineals	Displaced Pineals
A. Frontal			
Glioma	30	17	13
Meningioma	10	9	5
Met. carcinoma	3	1	0
Osteoma	1	1	0
Myeloma	1	0	0
Osteosarcoma	1	0	0
	46	28	18
B. Temporal			
Glioma	41	18	12
Meningioma	15	7	4
Met. carcinoma	2	1	0
Tuberculoma	1	1	1
Osteoma	1	0	0
Cholesteatoma	1	0	0
Chordoma	1	1	1
	62	28	18
C. Parietal			
Glioma	20	9	4
Meningioma	5	3	1
Met. carcinoma	4	1	0
Gumma	1	1	0
Met. sarcoma	1	0	0
Osteoma	2	1	0
	33	15	5
D. Occipital			
Glioma	13	8	5
Meningioma	3	3	1
Met. carcinoma	2	2	1
Angioma	3	1	0
	21	14	7
E. Cerebellar			
Glioma	30	8	4
Meningioma	6	5	1
Met. carcinoma	2	0	0
Angioma	3	2	0
Tuberculoma	5	1	0
Papilloma	1	1	1
Cholesteatoma	2	1	1
Xanthoma	1	0	0
Chordoma	1	1	1
	51	19	8
F. Hemisphere			
Glioma	31	17	10
Meningioma	6	4	3
Met. carcinoma	2	2	2
Angioma	3	1	1
	42	24	16
G. Parasagittal			
Glioma	1	0	0
Meningioma	12	5	2
Gumma	1	0	0
	14	5	2
H. Fourth Ventricle			
Glioma	45	13	5
Papilloma	2	0	0
	47	13	5

(exclusive of craniopharyngiomas), 58 had a visible pineal shadow but only 8, or 13 per cent, were displaced. Of the 39 acoustic neurinomas, 28 had a visible pineal shadow and 6, or 21.4 per cent, were displaced. Of 26 cases of craniopharyngioma, 4 had visible pineals, 2 of which were displaced. In Table 1 the location and histological type of the 474 verified intracranial tumors in relation to the roentgen study of the pineal is given.

Other tumors in various locations are as follows:

	Total Cases	Visible Pineals	Displaced Pineals
I. Optic chiasm glioma	5	0	0
J. Third ventricle glioma	5	3	0
K. Corpus callosum glioma	1	1	0
L. Olfactory groove meningioma	9	6	3
M. Suprasellar meningioma	6	5	1
N. Sphenoid ridge meningioma	3	1	0
O. Left ventricle papilloma	1	0	0
P. Torcular angioma	1	1	1

Q. Gasserian ganglian cholesteatoma.....	1	0	0
R. Acoustic neurinoma..	39	28	6
S. Craniopharyngioma..	26	4	2
T. Pituitary tumor..... (Adenocarcinoma 4) (Adenoma 87)	91	58	8

The remainder of the tumors in the miscellaneous group comprise one right frontal myeloma and an osteosarcoma, a parietal metastatic sarcoma, and a xanthoma situated in the cerebellum. In none of these cases was there a visible pineal. There were two chordomas, one situated in the right temporal lobe, which displaced the pineal to the left; the other was subtentorial and displaced the pineal forward and upward. Finally, there were two gummas. One was parasagittal and showed no pineal shadow. The other was in the left parietal region, and although the pineal shadow was visible there was no displacement.

In the neurinoma group of 39 tumors, there were 28 cases that had a visible pineal shadow, and of these 6, or 21.4 per cent, were displaced as follows: 2 forward and upward, 2 forward, one upward and one to the right. In this last case the tumor was located on the left side.

Tables II to V serve to illustrate the value of pineal displacment as an aid in the diagnosis of intracranial tumor.

TABLE II

SHOWING THE EFFECT OF GLIOMAS ON THE POSITION OF THE PINEAL SHADOW

Location	Total Cases	Pineal not Visible	*N–P*	*L–D*	*L*	*B–R*	*R*	*D*	*D–B–R*	*F*	*D–R*	*Up*	*B*	*L–U*	*F–U*	*D–B*	*L–B*
Frontal																	
Left	12	3	3				2						1		1	2	
Right	18	10	1										3			4	
Temporal																	
Left	21	13	1			2	2		1	2							
Right	20	10	5		3			1									1
Parietal																	
Left	7	3	2				1						1				
Right	13	8	3						1							1	
Occipital																	
Left	6	2	3								1						
Right	7	3		1	1					1							1
Cerebellar																	
Left	18	12	4							1			1				
Right	2											1		1			
Hemisphere																	
Left	13	6	4			1							1			1	
Right	18	8	3		1		1	1		2						1	1
4th ventricle	45	32	8					1		1		2	1				
Optic chiasm	5	5															
3rd ventricle	5	2	3														
Parasagittal	1	1															
Corpus callosum	1		1														

Location = position of tumor; Total = total number of tumors of this type in the area specified; *N–P* = normal position; *L* = left; *R* = right; *L–D* = left and downward; *B–R* = backward and to the right; *D* = downward; *F* = forward; *D–R* = downward and to the right; *Up* = upward; *B* = backward; *L–U* = left and upward; *F–U* = forward and upward; *D–B* = downward and backward; *L–B* = left and backward.

In the 26 cases of craniopharyngioma, only 4 had visible pineals and 2 of these were displaced as follows: one forward and upward, one to the right.

In the pituitary tumor group there were 91 cases, including the 4 adenocarcinomas of the pituitary gland. Of this number 58 had visible pineal shadows and 8, or 13.7 per cent, were displaced as follows: 4 forward, one forward and upward, 2 backward and downward, and one to the right.

DISCUSSION

Before proceeding further, attention is called to the fact that all measurements recorded were made without knowing whether the case being examined was one of intracranial neoplasm or not, except, of course, in those instances in which definite calcification or bony involvement was obviously present. In other words, the study made was as free of bias as possible.

In addition to the pineals which have been reported as being displaced in the cases of verified tumors, there were 165 cases with displaced pineals in which there was no verified tumor to explain their abnormal position. However, even though this is a large group, many of the cases may be accounted for in the following manner. There were 230 patients with a diagnosis of "tumor, unverified," and 299 classified as "tumor suspects," a total of

TABLE III

SHOWING THE EFFECT OF MENINGIOMAS ON THE POSITION OF THE PINEAL SHADOW

Location	Total Cases	Pineal not Visible	*N–P*	*L–D*	*R*	*D*	*F*	*Up*	*B*	*F–U*	*D–B*	*B–D–L*	*B–D–R*	*F–D–R*
Frontal														
Left	5	1	2								2			
Right	5		2							1	1	1		
Temporal														
Left	6	1	2		1	1					1			
Right	9	7	1	1										
Parietal														
Left	4	1	2										1	
Right	1	1												
Hemisphere														
Left	4	1	1		1			1						
Right	2	1				1								
Occipital														
Left	2		1											1
Right	1		1											
Sphenoid ridge														
Left	2	1	1											
Right	1	1												
Olfactory groove	9	3	3			1			2					
Suprasellar	6	1	4						1					
Parasagittal	12	7	3			1	1							
Subtentorial	6	1	4					1						

Location = position of tumor; Total = total number of tumors of this type in the area specified; *N–P* = the pineal was in the normal position; *L–D* = left and downward; *R* = right; *D* = downward; *F* = forward or anteriorly; *Up* = upward; *B* = backward or posteriorly; *F–U* = forward and upward; *D–B* = downward and backward; *B–D–L* = backward, downward and to the left; *B–D–R* = backward, downward and to the right; *F–D–R* = forward, downward and to the right.

TABLE IV

SHOWING THE EFFECT OF THE MISCELLANEOUS TUMORS ON THE POSITION OF THE PINEAL SHADOW

A. *Metastatic Carcinoma*

Location	Total Cases	Pineal not Visible	N-P	R	L
Hemisphere					
Left					
Right	2			1	1
Frontal					
Left					
Right	3	2	1		
Parietal					
Left	2	2			
Right	2	1	1		
Temporal					
Left	2	1	1		
Right					
Occipital					
Left	1			1	
Right	1		1		

B. *Osteoma*

Location	Total Cases	Pineal not Visible	N-P
Frontal			
Left			
Right	1		1
Temporal			
Left	1	1	
Right			
Parietal			
Left	1	1	
Right	1		1

C. *Papilloma*

Location	Total Cases	Pineal not Visible	F-L
Fourth Ventricle	2	2	
Left Ventricle	1	1	
Cerebellopontine angle, R	1		1

D. *Angioma Arteriosis*

Location	Total Cases	Pineal not Visible	N-P	R
Hemisphere				
Left	2	1		1
Right	1	1		
Occipital				
Left	2	1	1	
Right	1	1		
Cerebellar	3	1	2	
Torcular	1		1	

E. *Tuberculoma*

Location	Total Cases	Pineal not Visible	N-P	R-D-B
Cerebellum	5	4	1	
Temporal				
Left	1			1

F. *Cholesteatoma*

Location	Total Cases	Pineal not Visible	N-P	F-D
Temporal				
Left	1	1		
Cerebellum				
Left	1	1		
Right	1			1
Gasserian ganglian				
Left	1	1		

529 cases. These doubtless account for a considerable number of the displaced pineals not included in the verified tumor series. The exact significance of this group of pineals is, however, difficult to determine.

Again, there is another rather large group of cases in which an anterior displacement of the pineal shadow was apparent. There were 75 pineals which were anterior to the normal position, all in dolichocephalic skulls. In most of these the displacement was very slight and prob-

ably was of no significance, and this was noted at the time the measurements were made. In only a few instances was such a notation later proved to be erroneous by the finding of a tumor. Even though one includes the 165 cases of displaced pineals not definitely accounted for by the presence of intracranial pathology, there would be only 14 per cent of displacements as against 39 per cent in the verified tumor group, and against 56.3 per cent in the glioma series and 43.7 per cent in the meningioma series. However, in all probability, a considerable number of the 165 pineals were actually displaced by tumors, and it is felt therefore, that a figure well below 14 per cent represents a truer number of pineals outside of the usual range in normal skulls.

SUMMARY AND CONCLUSIONS

(1) A fairly accurate method of measuring the pineal shadow is available as an aid in the localization of intracranial neoplasm.

(2) The pineal gland was displaced in 39 per cent of all patients with verified intracranial tumors.

(3) When an intracranial tumor displaces the pineal shadow, it displaces it away from the tumor, except apparently in the case of lesions involving the pituitary gland.

(4) The pineal gland was displaced in 56.3 per cent of the patients with gliomas and in 43.7 per cent of the patients with meningiomas.

(5) A figure somewhat below 14 per cent represents the number of pineals which are situated outside of the normal zone in normal skulls and most of these apparently are situated anterior to this zone.

(6) The perpendicular laying down of bone in the outer table of the skull of the type demonstrated is probably an indication of a rather rapidly growing skull.

(7) The thickened and irregular inner table of the frontal bones is almost five times as frequent in females as in males.

(8) In this series of cases, the presence of tumors of the pituitary gland or craniopharyngiomas has no causative relation to calcification in the pineal gland or in the choroid plexus.* †

* I wish to express my sincere appreciation to Dr. Harvey Cushing for the privilege of studying and reporting this series of his cases, and also to Dr. M. C. Sosman, under whom this study was made.

† For discussion see page 628.

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Vol. XXIII, No. 6

INTRACRANIAL PRESSURE

THE CORRELATION OF CHOKED DISC AND ROENTGENOLOGIC PRESSURE SIGNS*

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TWO of the most valuable procedures at the present time in the measurement of intracranial pressure are the examination of the eyegrounds and the determination of changes in the skull by means of the roentgen ray. Soon after the invention of the ophthalmoscope by Helmholtz in 1850, the relation between choked disc and intracranial disease was pointed out by von Graefe. Similarly, it was not long after the momentous discovery of Roentgen that the skull changes due to increased intracranial pressure were reported by Schüller. The direct measurement of intracranial pressure not only is somewhat difficult but it may be dangerous to the welfare of the patient. These two methods have therefore come to be relied upon in the diagnosis of intracranial lesions.

There is frequently, however, a discrepancy between the clinical findings and the signs of increased intracranial pressure as demonstrated roentgenographically. A patient with a high elevation of the optic discs may show no signs of increased pressure in a roentgen film of the skull. Furthermore, a large intracranial tumor may be present without producing a choked disc or giving any roentgen evidence of pressure. These observations led to a study of a group of intracranial tumors in an attempt to correlate the clinical and roentgen findings. For this purpose the films and the histories have been carefully reviewed in all cases of verified intracranial tumor discharged from the Peter Bent Brigham Hospital between January, 1926, and May, 1929.

In this series of observations the various degrees of intracranial pressure, as shown in the roentgenogram, are designated as slight, moderate and marked. These estimations are based mainly on the number and depth of the convolutional impressions; the atrophy of bone, especially at the base and about the sella; and the separation of the sutures in younger subjects. It is obvious that these estimations to a large extent are only relative, since there is usually some personal variation in evaluating the signs of intracranial pressure from the roentgenogram. This is likewise true in measuring papilledema, the diopters of elevation recorded depending somewhat on the particular observer and the particular moment of observation.

In the forty-month period under consideration, there were 615 cases of verified tumors discharged from the service of Dr. Cushing. These included new patients as well as a number who had previously been operated upon. The latter usually reentered the hospital either because of a recurrence of symptoms or because it was felt that further operative interference could be successfully attempted.

It may be of interest at this point to note that in those cases in which the tumor has been removed or a decompression performed at a former entry, there is almost always a decrease in or complete disappearance of the roentgen pressure signs on a subsequent admission unless there is choked disc at the time. This may be briefly illustrated by a comparison of the films of the skull taken before and after operation in a case of a tumor of the fourth ventricle in a child. Here such a disappearance of the signs of increased intracranial pressure is shown in the roentgenogram. The patient had a marked papilledema at the time the preoperative

* From the Surgical Department of the Peter Bent Brigham Hospital. Read at the Thirtieth Annual Meeting, American Roentgen Ray Society, New York City, Sept. 17–20, 1929.

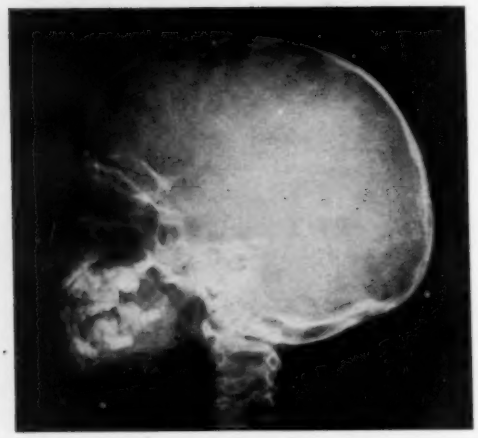

Fig. 1. Preoperative film showing signs of increased intracranial pressure in a case of tumor of the fourth ventricle.

film was made (Fig. 1). When the second film was made, six months after the cerebellar decompression, there was bilateral optic atrophy with no elevation of the discs. The convolutional impressions had almost disappeared and the sutures were again approximated (Fig. 2).

The large group of tumors in the pituitary region is of little value for this study since the symptoms in these cases are due to local pressure changes rather than to generalized intracranial pressure. With the rare exception of a craniopharyngioma, they are not commonly associated with choked disc or with changes in the roentgenogram indicative of increased intracranial pressure.

Excluding those cases previously operated upon, the whole pituitary group, and the rarer types of tumors, there remain three fairly large and almost equal groups which for the purpose of this study are comparable. These are: (1) the rapidly invasive; (2) the slowly invasive, and (3) the non-invasive intracranial tumors. It will be shown that the relation between choked disc and the roentgen signs of increased intracranial pressure in any given case depends greatly upon the particular group under which the tumor is classified.

It may be said that the position of a tumor in relation to the ventricular circulation is often a greater factor in producing increased intracranial pressure than its size or pathology. A slow-growing meningioma, for example, may reach an enormous size, distorting the ventricle and shifting the pineal shadow without causing an appreciable increase in intracranial pressure. On the other hand, a very small, rapidly invasive tumor with surrounding edema may rapidly give symptoms of increased pressure. In the former instance the ventricular system gradually adapts itself to the great distortion caused by the tumor so that no interference with the fluid circulation occurs, whereas with a rapidly invasive lesion the fluid is blocked before there is any time for such adaptation to take place.

(1) *The Rapidly Invasive Tumors.* In this group are included the cases of glioblastoma multiforme and metastatic carcinoma, there being 43 of the former and 15 of the latter. The average duration of symptoms from the time of onset to the hospital entry was slightly less than four months for the whole group. The majority of the patients were middle-aged individuals.

Of the 43 cases of glioblastoma multiforme, 10 showed slight pressure changes and 2 moderate signs of pressure in the roentgenogram. There was pineal displacement in 7 cases, but in none of these was there roentgen evidence of increased

Fig. 2. Postoperative film showing diminished pressure in the same case as in Figure 1.

Fig. 3. Case 1. Showing absence of pressure signs in a case of a rapidly invasive tumor. Note pineal shadow (arrow).

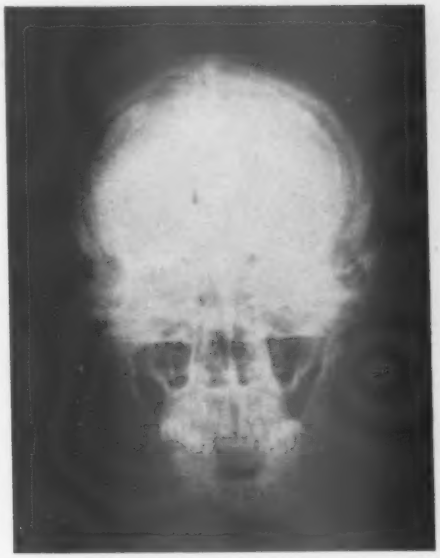

Fig. 4. Case 1. Anteroposterior view, showing pineal shift to the left (arrow).

pressure. Choked disc was found in all but 7 cases, the average elevation being three diopters.

Of the 15 cases of metastatic carcinoma, only 2 showed slight pressure changes in the roentgenogram, while the rest were reported as being within normal limits. Two showed displacement of the pineal gland without increased pressure. In every one of the 15 cases there was a high degree of choked disc, the average elevation being over three diopters.

In this whole group of 58 rapidly invasive tumors, then, the average duration of symptoms was about four months, 24 per cent of the cases showed slight pressure changes in the roentgenogram, and in 88 per cent choked disc was present.

The following case may be given as illustrative of this type of tumor.

Case 1. P.B.B.H. Surg. No. 32641. C.A., male, aged forty-two, admitted Nov. 10, 1928, complaining of blurred vision for four months; fronto-occipital headaches with diplopia for seven weeks; nausea and vomiting for three weeks.

Examination disclosed *bilateral choked discs* of 3 diopters elevation; exaggerated deep reflexes on the left side; left homonymous hemianopsia.

The roentgen report read: "Examination of the skull shows a thin vault *without localized changes or signs of increased pressure* (Fig. 3). The sella appears normal. The mastoids are clear. The *pineal appears definitely displaced to the left* (Fig. 4), being 1.5 cm. from the midline, but by measurements is not displaced in anteroposterior or vertical dimensions. The findings indicate a right cerebral tumor."

Subsequently a post-mortem examination revealed a large right occipital glioblastoma multiforme (Fig. 5).

Fig. 5. Case 1. Large glioblastoma multiforme disclosed at necropsy.

FIG. 6. Case II. Film showing moderate pressure signs in a case of slowly invasive tumor.

(2) *The Slowly Invasive Tumors.* Sixty-three cases of astrocytoma, including both fibrillary and protoplasmatic types, represent this group. The average duration of symptoms was two years. In 36 cases (57 per cent) there was evidence of increased intracranial pressure in the roentgenograms, 22 per cent being described as showing slight signs, 28 per cent moderate signs, and 6 per cent marked signs of pressure. It is of interest that in 4 cases where the duration of symptoms was less than two months, there was no roentgen evidence of increased intracranial pressure which corresponds with the findings in the rapidly invasive group where the history is also very short. Pineal displacement was noted in 11 cases.

Examination of the fundi showed choked disc in 86 per cent of the cases.

The following is quite typical of the usual roentgen findings in the cases of slowly invasive tumors.

CASE II. P.B.B.H. Surg. No. 30822. W. C., male, aged thirty-six, admitted March 3, 1928, complaining of generalized headache and failing vision for two years; right-sided Jacksonian attacks for eight months; blindness of right eye four months; unconscious spells.

Examination showed *bilateral choked discs* of 4 to 5 diopters, with secondary atrophy; anosmia.

The roentgen report read: "Examination of the skull shows *moderate signs of increased pressure*, particularly in the frontal region (Fig. 6). The sella is not enlarged. The floor appears slightly irregular and the posterior clinoids are thinned. The pineal is apparently in the midline stereoscopically, but by measurements is at the posterior and inferior limits of normal."

By means of a ventriculogram the diagnosis of a large right frontal tumor was made, and at operation a fibrillary astrocytoma was removed by Dr. Cushing.

(3) *The Non-invasive Tumors.* This group of 63 cases comprises those tumors arising from the meninges (meningiomas). In 13 of these cases the tumors were located in the region of the sphenoidal ridge, the olfactory groove, and over the sella, producing symptoms due to local pressure in the region of the chiasm rather than to generalized intracranial pressure. Four of these showed slight pressure changes in the roentgenogram. In 8 cases there was an optic atrophy, and in 3 cases one nerve head was atrophic while the other was elevated.

The remaining 50 meningiomas gave an average duration of symptoms of over four and a half years. In 28 per cent of this group the roentgen signs of pressure were slight, in 12 per cent moderate, and in 4 per cent they were marked. Choked discs were present in 71 per cent of the cases, the average elevation being three diopters.

The next case illustrates how a non-invasive tumor may reach an enormous size without giving any evidence of intracranial pressure either by roentgen or ophthalmoscopic examination.

CASE III. P.B.B.H. Surg. No. 32961. C.C., male, aged twenty-eight, reported to the Out-Door Department in December, 1929, with the complaint that during the preceding eight months he had had two severe attacks of headache and that he was unable to see objects to his left.

Examination was entirely negative, except for a left homonymous hemianopsia. There was *no elevation of the optic discs*. The *roentgenograms* were regarded as being *within normal limits* (Fig. 7).

By means of a ventriculogram a diagnosis of right occipital meningioma was made. Subsequently a tumor weighing 120 grams was removed in toto by Dr. Cushing (Fig. 8).

Fig. 8. Case III. Showing meningioma removed at operation.

COMMENT

In reviewing the three groups of tumors described, it is apparent that a definite duration of time is necessary for the production of roentgen evidence of increased intracranial pressure. No cases in which the pressure symptoms were of less than two months' duration disclosed abnormal signs in the roentgenogram. The rapidly invasive tumors, which are accompanied by the highest percentage of choked disc, show the lowest percentage of roentgen pressure signs, due, no doubt, to their short history. The increased intracranial pressure caused by the meningiomas is often intermittent, hence there is a relatively low percentage of roentgen pressure signs in these cases in spite of the long duration of symptoms. The group which shows the highest number of cases in which there is evidence in the roentgenogram of increased intracranial pressure is the slowly invasive group of astrocytomas. Here there is more or less constant pressure over a period long enough to produce erosion of the skull.

Fig. 7. Case III. Showing absence of pressure signs in a case of non-invasive tumor without choked disc.

CONCLUSIONS

1. Signs of increased intracranial pressure in the roentgenogram may disappear after operation.

2. Rapidly invasive intracranial tumors show the highest percentage of cases with choked disc and the lowest percentage with roentgen signs of increased pressure.

3. Slowly invasive tumors show the highest percentage of cases with roentgen signs of increased pressure, usually in association with choked disc.

4. Non-invasive intracranial tumors may attain great size without giving roentgen evidence of increased intracranial pressure and without producing choked disc.*

* For discussion see page 628.

BONE CHANGES IN EXPERIMENTAL PITUITARY DISORDERS*

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OUR knowledge of the physiology of the hypophysis is even more recent than the science of roentgenology. In the clinic, at least, it is largely by the aid of roentgenology that we can estimate the presence and degree of pituitary disorder, and we are largely dependent on radiation in the treatment of many tumors of the hypophysis. The roentgen aspects of tumors of the hypophysis, of acromegaly and of dwarfism are well known, and I will limit myself to the experimental aspects of the subject.

It is only within the last quarter of a century that an experimental approach to the problem has been developed. With the two or three types of cells in the anterior lobe, the problematical middle lobe, the posterior lobe, and the great variety of vegetative centers in the floor of the third ventricle above it, it is extremely difficult to disentangle causes and events in the laboratory as well as in the clinic.

Let us begin with the briefest subjects. The posterior lobe, composed of harmless looking neuroglia, yields the official pituitary extract which causes the uterus to contract, is an anti-diuretic, and raises blood pressure. Extirpation of the posterior lobe alone causes no noteworthy symptoms in animals, as was first clearly shown by Cushing. Repeated administration of the extract causes some emaciation, but no specific structural changes.

Little is now heard of the intermediate lobe, though it endured the blame for many disorders a few years ago. Indeed, it now appears rather doubtful whether it exists at all in human beings.

The floor of the third ventricle is a most exciting and mysterious domain, of which one must be ready to believe almost anything. It seems clear, however, that appropriate lesions here will cause adiposity, often extreme, sexual impotence, and polyuria. Adiposity and polyuria have not been clearly demonstrated to result from any type of injury to the hypophysis itself, and are seen clinically in encephalitis, for example, when the hypophysis is intact. They occur in certain cases of pituitary tumor, of course, but probably secondarily.

Finally, we come to the anterior lobe. Cushing's early work indicated, and Aschner's most definitely showed, that extirpation of it leads to a cessation of growth in young animals, with failure of the epiphyses to unite, a persistence of downy hair, and sexual infantilism or atrophy. A comparable condition is recognized clinically as the Lorain type of dwarfism—the "perfect midgets" of the circus side-show, in whom the hypophysis has been wholly or largely destroyed by infarction or tumor.

If dwarfism is the result of a lack of the pituitary, it would seem reasonable that gigantism and its obviously related disease, acromegaly, should be due to an excess of secretion. But any experimental demonstration of this was lacking until Evans of California succeeded in producing a series of enormous rats which outweighed their litter-mate controls by 200 per cent or more, as a result of long-continued daily injections with beef anterior lobes. It is not until one tries to repeat Evans' work that one realizes why it was not done before. The extract must be made from anterior lobes alone, at the rate of about one beef per day per rat; it cannot be heated or made acid or preservatives added; it is difficult to sterilize, and keeps poorly at best. So it is a tedious and discouraging experiment.

Now, the picture produced by Evans and his coworkers was that of gigantism,

* Read at the Thirtieth Annual Meeting, American Roentgen Ray Society, New York City, Sept. 17–20, 1929.

not acromegaly. Except for some alterations in the gonads, the experimental rats were merely large. There was none of the overgrowth of acral parts and none of the symptoms characteristic of acromegaly. This is presumably because the epiphyses never unite in the rat.

At Dr. Cushing's suggestion, Dr. Teel, Dr. Benedict and I attempted to extend the experiment to dogs. The story of our difficulties and disappointments has been told elsewhere. Here I wish merely to outline some of our positive results.

Several litters of dogs of various breeds were used. The largest of each litter was saved as a control. An increased rate of growth and certain specific changes were observed in all of the injected animals. The mortality was high, owing to the vicissitudes of life in the laboratory, and only one animal and its control lived over a year. I shall confine my description chiefly to this pair.

The first change which was observed in the injected animal, aside from the increased rate of growth, was a weakness of the extensors of the foot, so that it walked in a plantigrade, rather than the normal digitigrade manner. Then other muscles became weak; the spine drooped between the shoulders, and the head below the spine. The jaw became prognathous. The tongue was so large it could scarcely be contained within the mouth, and saliva dripped from it constantly. The udders hypertrophied, and colostrum could be squeezed from them. The animal failed to go into heat at the time her control did. Treatment was continued for fourteen months, and then one warm July day, the dog died, apparently of cardiac failure and edema of the lungs.

There was an extraordinary general splanchnomegaly. Thyroid, heart, liver, pancreas, and kidneys were greatly enlarged. Most amazing of all was the tremendous hypertrophy of ovaries, uterus and vagina.

The bone changes which we were able to follow during life by courtesy of Dr. Sosman and the roentgenological department of the Peter Bent Brigham Hospital were in the nature of a generalized hypertrophy, most marked at the epiphyses. The lower jaw extended far beyond the upper one, and it was asymmetrical, apparently as a result of habitual malocclusion. The teeth were carious and widely spaced. The cranium was unusually heavy and rugged, in striking contrast to that of the control.

The vertebrae individually were also greatly hypertrophied. The lower lumbar vertebrae were heavily lipped, and practically immobilized in a scoliotic position by flakes of bone in the anterior spinal ligament.

The long bones were increased in length, breadth and density. Many of them, but especially the humeri and tibiae, showed extensive osteophytic growths about the head, closely similar to those seen in hypertrophic arthritis. The joint surface was normal, however.

Taken all together, the functional and structural disturbances appear much like those seen in human acromegaly.

This is only a brief account of the growth promoting portion of the anterior lobe. Obviously, there is much more that might be said about it. In addition to the hormone producing excessive growth, there appears to be one which induces premature sexual maturity in young female animals, in the anterior lobe also. But our knowledge of this is too fragmentary and conflicting to merit discussion here.

DISCUSSION

Chairman Sosman. Dr. Putnam is anxious to get back to Boston, and I will call for any questions or discussion on his paper at this time in order to allow him to leave.

Question. Does it cause the dogs to die soon?

Dr. Putnam. I think undoubtedly the extract was implicated in the death of this dog. It was in the hot sun and had suddenly devel-

oped a pulmonary edema and dilatation of the heart. In view of the great weakness of all the skeletal muscles, I think it is reasonable to assume that the heart muscle also was enfeebled by the injection of the extract.

QUESTION. Does it have any influence on other than the young animal?

DR. PUTNAM. Yes, adult animals appeared to react even more markedly than young ones do. In young animals the rate of growth is so rapid naturally that it is very hard to make one outstrip the other, but it is not difficult in adult animals.

CHAIRMAN SOSMAN. I think one of the striking things that Dr. Putnam perhaps did not emphasize was that the experimental acromegaly involves the whole body, the visceral organs as well as the skeleton visible in the x-ray. I don't think we realize that ordinarily the heart, the tongue, the thyroid, the uterus, all of the viscera are enlarged in the same proportion as the jaw, the hands, and the bones.

Vol. XXIII, No. 6

INTRACRANIAL CALCIFICATION AND ITS ROENTGENOLOGIC SIGNIFICANCE*

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CALCIFICATION within the skull has long been of interest to the roentgenologist, and time and experience have shown that its presence is of increasing significance in the differential diagnosis of intracranial lesions. From a state in which every shadow of calcification invited the diagnosis of a brain tumor, knowledge of these changes has advanced to the point where, within reasonable limits, the normal may be distinguished from the abnormal, and the nature of both may be predicted with surprising certainty.

Ström placed intracranial calcification in two groups, the physiologic and the pathologic. The former includes such structures as the pineal gland, choroid plexus, falx cerebri and pacchionian bodies which normally may exhibit varying amounts of calcium. The pathologic group includes all tumors and certain nontumorous affections.

Weed, in a histologic study of calcifications in cerebral neoplasms, classified the morphology of calcified bodies as follows:

1. Punctate. Under this heading are included the commonest forms of calcium. On microscopic section the forms appear as small circular bodies, at times irregularly outlined, showing a characteristic staining reaction. Two forms are found: (*a*) psammoma bodies, without apparent internal structure to the mass, the external circular form being characteristic, and (*b*) corpora amylacea, in which the characteristic concentric rings, simulating starch granules, are made out.

2. Vascular. This includes deposits of calcium which morphologically represent the replacement of a whole vascular channel by the deposition of lime. On microscopic examination they show the solid, cord-like appearance of an occluded vessel, branching forms being frequently encountered.

3. Trabecular. This variety comprises those irregular, plate-like collections of lime salts which are found in the fibrous trabeculae of the various neoplasms which have a fibrous framework. The deposit may be a very small spicule in the interstices of the trabeculae or it may be a very large plaque displacing the fibrous strands.

4. Amorphous. Included in this subdivision are the deposits of lime salts which do not show characteristic or constant morphology, but which are really a sort of amorphous calcium débris.

5. Periarterial. In this form, the calcium deposit encircles the arteries as a ring, first described by Beadles in a case of telangiectasia of the frontal lobe.

Although these forms pertain to the microscopic changes, they are, nevertheless, applicable in many instances to the gross and roentgen appearances as will be shown.

PHYSIOLOGIC CALCIFICATION

Statistics, based on roentgenograms, show that calcification within the pineal gland is visible in 60 per cent of adults aged more than twenty years and may be discerned as early as the age of ten years.[18] Normally it is seen in the roentgenogram as a single small opacity or an ovoid cluster 0.5 to 1 cm. in diameter, composed of small calcified areas situated in the median line, above and slightly posterior to the petrous portion of the temporal bone. Occasionally the periphery of the shadow may have a ring-like appearance. Displacement of the

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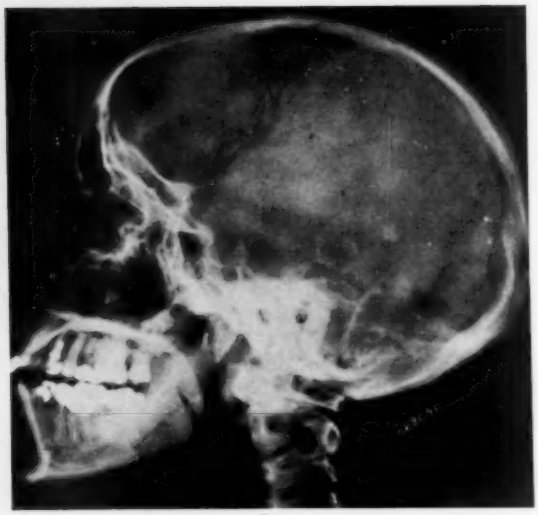

FIG. 1. Bilateral calcification of the choroid plexus. The conglomerate punctate shadows are well shown.

shadow, especially to either side of the median line, is of value in determining the presence of a neighboring neoplasm. Downward or upward displacement is less easily discerned. Landmarks and average measurements for accurate determination of displacement of the pineal shadow have been described by Vastine and Kinney.

Calcification in the choroid plexus, although frequently demonstrable microscopically, has received little mention in roentgenologic literature. The faint character of the shadow in many instances, and the fact that it is frequently misinterpreted as a calcified pineal gland and even a tumor, no doubt accounts for some of this oversight. Schüller has stated his belief that it is not possible to take a picture showing slight calcification of the choroid plexus. In my experience calcification of the choroid plexus is demonstrable in roentgenograms relatively often. The calcification is seen as a small cluster of ring-shaped shadows simulating in appearance tiny glass beads. The whole mass varies in size from 0.5 to 1.5 cm. in diameter, and is usually bilateral (Figs. 1 and 2). In all of the cases observed, the shadows were found in a position corresponding to the juncture of the body of the lateral ventricle with the inferior horn. Unilateral calcification may occur and in such instances is often confounded with a calcified pineal gland, especially in the lateral view, and even in an anteroposterior view it may be mistaken for a displaced pineal gland. The dangers of such an erroneous impression are obvious. In properly executed roentgenograms the clustered, circinate shadows of the choroid plexus are readily distinguished from the more irregular group depicting the calcified pineal gland which is situated lower and more anteriorly than the choroid plexus. A good anteroposterior film will facilitate the distinction. Meyer stated that calcification in the pineal gland and choroid plexus has different morphologic characteristics, and calcification in tumors of these structures has the same appearance. This differentiation is most

FIG. 2. Bilateral calcification of the choroid plexus. Anteroposterior view showing symmetric bilateral distribution of the shadows.

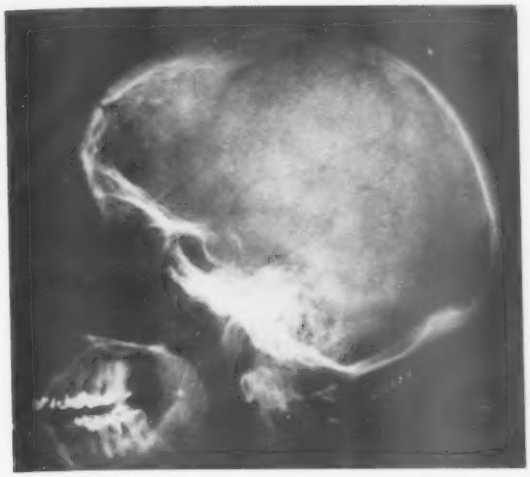

Fig. 3. Irregular plaques of ossification in posterior portions of falx cerebri.

important when the area of calcification is of such size as to suggest the possibility of tumor. Tumors of the lateral ventricles containing psammoma bodies are rare, but when present they may simulate unilateral calcification of the choroid plexus.

Calcification in the falx is commonly observed, especially in persons more than thirty years of age. There is some difference of opinion as to whether this is more properly called ossification, since many of the plaques exhibit true bone structure, with lacunar systems, haversian canals, osteoblasts, and osteoclasts. Grossly they appear to lie beneath or in the dura, but microscopically they are in a cellular mass. According to Cushing and Weed, the appearance of the cells, their situation, and their relation to the surrounding dense strands of dural tissue, mark them as undoubtedly of arachnoid origin. The hyperplastic appearance of these cells suggests the structures often accompanying calcareous bodies, and it would appear that as a result of similar influences the arachnoid may become involved in the two processes. From the roentgenologic standpoint it is not necessary to make such a fine distinction, since both calcification and ossification may occur at one and the same place, and they appear to be more or less related to each other.

Calcification and ossification occur most commonly in the frontal portion of the falx cerebri, close to the frontal bone, and may extend posteriorly as a continuous bony plate involving the entire falx. Irregular and isolated plaques in the posterior portion of the falx are not uncommon (Fig. 3). They may also extend from the median line across the superior surface of each hemisphere, although such a change is not frequently seen. The dense, white, perpendicular shadow, depicting the calcareous or osseous plaques, edge on in the median line in the anteroposterior view, is familiar to most roentgenologists. When the changes extend across the hemispheres, the shadow is T-shaped (Fig. 4). In the lateral view, the thin, flat plaques are frequently obscured by the overlying bone of the vault

Fig. 4. Calcification of falx cerebri extending across the superior surface of each hemisphere.

of the skull, and since the shadows are usually most dense at their superior or anterior edges, they may be mistaken for ridges in the bone, especially in the frontal and occipital areas. In other instances the shadows may even simulate calcium within a tumor or within the pineal gland. An anteroposterior film should make the differentiation easy.

Calcification in the tentorium cerebelli is rare, but if present it is disclosed in the lateral view as a wedge-shaped shadow placed horizontally in the position of the tentorium.

Halstead and Christopher have stated that ossification is never found in the dura covering the base of the skull. Such changes, however, in my experience are common in the tentorium, running downward from the posterior clinoid processes, across the dorsum sellae, and adjacent to the sphenoid bone. In a lateral roentgenogram these changes are shown as a dense linear shadow varying from 1 to 4 mm. in thickness, which extends downward and posteriorly, adjacent and parallel to the dorsum sellae and basisphenoid (Fig. 5). They are frequently seen at necropsy as spicules of bone in the tentorium attached to the posterior clinoid processes.

Calcification and ossification in the meninges, on the lateral aspect of the brain, are not common. I have seen one case (Fig. 6) in which there was marked ossification of the meninges on the right side.

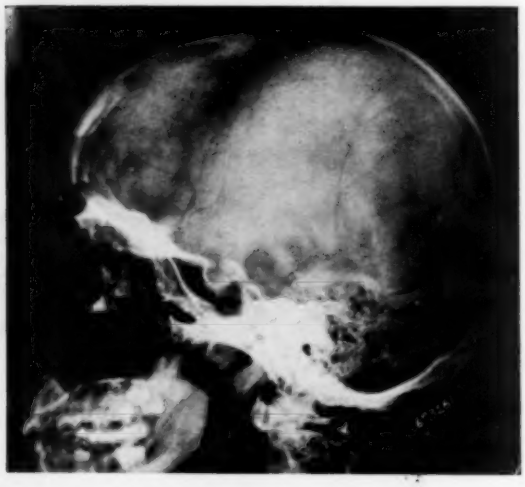

FIG. 5. Calcification in tentorium attached to the posterior clinoid processes.

FIG. 6. Extensive calcification in the meninges on the right side of the brain.

Calcification of the pacchionian bodies is relatively uncommon; in the last six months I have observed only two cases in a rather large series of routine examinations. These shadows,which vary from 3 to 8 mm. in diameter, are found in the median line or just to one side of the median line, from the frontal to the occipital regions. Single or multiple bodies may be visible, and the shadows are frequently seen to be in close apposition to areas of rarefaction in the bone, which represent the so-called pacchionian depressions. Anteroposterior and lateral roentgenograms should make the diagnosis easy.

PATHOLOGIC CALCIFICATION

The incidence of calcification in intracranial lesions has been variously appraised. Weed, in a study of 55 cerebral neoplasms, found microscopic evidence of calcification in 40 per cent. An analysis of the different types of tumors showed that this percentage held constant throughout the true cerebral neoplasms. The slightly greater frequency with which deposits of lime are observed in endotheliomas than in glial

Fig. 7. Calcification in a large glioma in the right parietal area. The irregular trabeculated nature of the calcification is well shown.

tumors accords with the old theory that these depositions occur more commonly in the old slowly growing tumors. The absence of calcium in the metastatic growths is significant. It is obvious that roentgen statistics which depend on gross evidence of calcification cannot imitate these percentages.

Crouse, in a review of the literature, stated that 3 per cent of intracranial new growths contain sufficient calcium to cast a shadow with the roentgen ray. Dandy, and also Ström, placed the incidence at 6 per cent. In a series of 781 verified lesions of the brain observed at The Mayo Clinic during the last ten years, calcification within the lesion was described by the roentgenologist in 7.6 per cent. Had surgical procedures been justifiable or indicated in many cases not included in this series but in which the roentgenogram showed abnormal areas of calcification, this percentage undoubtedly would be higher.

Lesions that may exhibit areas of calcification in the roentgenogram include tumors, hematomas, tubercles, aneurysms, old abscesses, areas of old meningeal disease and encephalitis. For practical consideration they may be divided into the neoplastic and non-neoplastic groups.

Of the neoplastic group, calcification is most common in the glial tumors, endotheliomas (meningiomas), suprasellar cysts (Rathke's pouch tumors), hemangiomas, dermoids, and cholesteatomas. Other tumors rarely calcify.

The gliomas, which make up the largest class of brain tumors, were found to show calcification in the roentgenogram in 11 per cent of Sosman's[17] series. In Weed's series, microscopic evidence of calcium was found in 33 per cent. In a series of 308 gliomas reviewed by me at The Mayo Clinic, calcification was observed in the roentgenogram in 5 per cent. Roentgenographically, the calcification in these tumors does not seem to assume any characteristic form. Usually, however, the shadows are coarse, irregular, and more or less streaked or trabeculated, and may involve a considerable area (Fig. 7.) The large cysts often accompanying degenerating gliomas seldom exhibit calcification.

Calcification in an endothelioma (meningioma) may occur in two different areas: (1) within the capsule or membrane sur-

Fig. 8. Parasagittal endothelioma in the left superior parietal area. The calcification in the capsule of the tumor simulates the calcification often observed in the falx cerebri.

rounding the tumor, and (2) within the tumor itself. In the first instance the shadows of the calcification closely simulate those of the calcific or osseous plaques found in the falx or meninges and may be confounded with such, especially if the tumor is of parasagittal origin (Fig. 8). Calcification within the tumor may be of two types: (1) punctate and discrete areas of density corresponding to the psammoma bodies which these tumors frequently contain (Fig. 9), and (2) a conglomerate mass of calcareous material.

Suprasellar cysts (Rathke's pouch tumors), which originate from the infundibulum of the pituitary gland, frequently show a tendency to calcify; such changes were observed roentgenographically in 70 per cent of McKenzie and Sosman's cases. According to Duffy, these tumors range in structure from simple cysts lined by squamous epithelium to tumors often reported as teratomas, and the entire group belongs to the heterogeneous hypophyseal tumors. Calcification in these tumors may be found about the outlet of the sella turcica, above the clinoid processes, posterior to the posterior clinoid processes, and even within the sella turcica itself. The shadows are often of a faint, irregular, flocculent nature, and may easily be overlooked if the film is not of the highest quality and free from motion. In many cases there appears to be clumping of the shadows, so that a dense calcified mass with very fuzzy and indistinct edges may be observed (Fig. 10). These tumors may be large, and in most instances the calcification represents only a part of the tumor. It is not uncommon for the walls of the cysts to calcify in a linear fashion and thus outline the tumor. Such changes were observed in one case (Fig. 11). Secondary changes in the bone resulting from pressure are frequent accompaniments of these tumors. The posterior clinoid processes are usually involved, and these structures are commonly eroded from above and may be destroyed altogether. Fragments of the clinoid processes may be elevated and may simulate areas of calcification. The sella turcica itself is usually flattened in appearance, and such changes will suggest an extrasellar lesion. Occasionally such a tumor will originate from that portion of the infundibulum below the diaphragm sellae, and thus will

FIG. 9. Large parasagittal endothelioma in the frontal area, showing punctate, discrete shadows of psammoma bodies and calcification of the surrounding capsule.

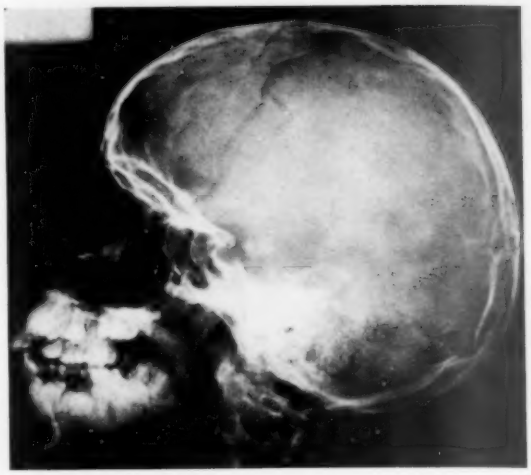

FIG. 10. Calcification in suprasellar cyst. The characteristic irregular and flocculent nature of the calcium shadows is well shown. The posterior clinoid processes and dorsum sellae are destroyed by pressure exerted from the tumor.

Fig. 11. Large suprasellar cyst showing calcification in the walls of the tumor, and producing extensive destruction of the sella turcica.

produce changes in the sella turcica suggesting an intrasellar tumor. The presence of calcification should facilitate the diagnosis of a Rathke's pouch tumor, since calcification within the adenomas and malignant tumors of the pituitary gland itself is exceedingly rare in comparison. In doubtful cases the youth of the patient, the association of Froelich's syndrome (70 per cent of cases), or the delay in the appearance of centers of ossification will help corroborate the diagnosis.

Calcification in dermoids and cholesteatomas may be mistaken for calcification in a Rathke's pouch tumor. Fortunately the former are rare, and only about 60 have been reported in the literature. When present, however, they show a predilection for the area about the sella turcica. Pathologically the classification of these tumors is not settled. Bailey stated that many dermoids and cysts in the region of the pituitary gland are erroneously called cholesteatomas. The calcification exhibited by these tumors as described in the literature and as I have observed, has nearly always been found in the walls of the cyst and is exhibited in the roentgenogram as a circular shadow depicting the outline of the cyst (Fig. 12).

The vascular, intracranial lesions (non-neoplastic) exhibiting calcification may, for practical consideration, be grouped into three types: (1) aneurysms of the cerebral arteries; (2) angiomatous malformations, chiefly capillary (telangiectatic), chiefly venous (angioma venosa), or chiefly arteriovenous (angioma arteriale) in their composition, and (3) hematomas.

Aneurysm of the cerebral arteries is limited chiefly to the vessels forming the circle of Willis, of which the middle and internal carotids are most frequently involved. Aneurysms containing calcium sufficient to render them opaque to roentgen rays are rare, as evidenced by the fact that of 10 observed in a period of ten years at Cushing's clinic,[17] only 25 per cent were visible in a roentgenogram. According to Lebert, calcified atheroma is rarely found in cerebral aneurysm. In the cases observed, the calcification has been exhibited as fine curved lines of increased density corresponding to the walls of the vessels, or laminated clot. The shadows in all instances have been found above or just lateral to the sella turcica. They are usually obscured in the anteroposterior view. Sclerosed vessels of the circle of Willis have the same appearance as calcified vessels elsewhere in the body, and the

Fig. 12. Large dermoid cyst with dense calcification in its walls.

demonstration of a fusiform or saccular enlargement of their contour is significant evidence of an aneurysm. Unilateral erosion of the sella turcica or clinoid processes may accompany the lesion. Areas of calcification in suprasellar cysts, dermoids and endotheliomas must be differentiated. The age of the patient or unilateral erosion of the sella turcica may help in this distinction. In the lateral view, localized areas of increased density in the temporal bone and temporal parietal suture may be confusing unless a good stereoscopic image is obtained.

FIG. 13. Large angioma in right occipital area showing characteristic areas of calcification.

FIG. 14. Old hematoma in right parietal area showing a characteristic dense, irregular form of calcification.

The venous and arteriovenous malformations, as Cushing and Bailey have stated, are primarily surface lesions of the hemisphere, and the types may be recognized as simple enlargement of a single vessel, simple enlargement of one or more vessels, or a more complicated (racemose) type, in which the lesion extends from the cerebral surface like an inverted cone, with its apex abutting on the ventricle, into which terminal hemorrhage sometimes occurs. Roentgenographic observations of calcification in these lesions appear to be limited to a group of 21 cases, reviewed by Weber. In the roentgenograms in this series, the characteristic appearance (Fig. 13) was observed in 8 instances. The shadows closely simulate diffuse calcification of an atrophic cerebral cortex, but because of the nature of the lesion they undoubtedly represent calcification in the walls of the tortuous vessels, and observations by Eaves in 2 cases would seem to substantiate this conclusion. It is regrettable that protocols of necropsies in Weber's study did not mention calcification in the angiomatous masses, although marked atrophy of the cerebral cortex, increased vascularity of the meninges and cortex, and thickening of the meninges were described. It is obvious that none of these changes is sufficient to explain the roentgen shadows which seem typical of calcification.

Calcification in hematomas that has been observed roentgenographically appears to be confined largely to areas within the substance of the brain itself. The changes are observed in roentgenograms as an irregular, dense shadow, roughly somewhat triangular in shape (Fig. 14). Shadows of this character have been found so frequently in old hemorrhagic areas, verified by necropsy or operation, that their presence in a roentgenogram

is of diagnostic significance. Subdural hematomas are rather common to the surgeon, but calcification sufficient to be opaque to the roentgen rays is exceedingly rare. Newell reported 2 cases of subdural hematoma showing calcification in the roentgenogram, but the condition was not verified.

Calcification in tuberculoma sufficient to be observed roentgenographically is not common. In the few cases that have been reported,[10] the area was visible as a dense, irregular mass of calcium varying from 1 cm. to about 2 cm. in diameter. Because of the caseous center, this portion of the shadow may be somewhat less dense.

Calcification in parasitic cysts, especially in the Cysticercus variety, has been reported by O'Sullivan and others. These lesions are relatively uncommon, especially in this country. In the 2 cases reported by O'Sullivan, the calcification was visible in the roentgenogram as multiple, "pea-sized," dense areas with somewhat irregular contours. It is not improbable that some of these lesions might produce annular shadows representing the walls of the cyst.

Miscellaneous lesions which may exhibit calcification are old abscesses, areas of old meningeal disease, and old encephalitis. Ström mentioned the presence of calcification in chronic encephalitis, but I have not been able to find any proved case in which calcification was demonstrable in the roentgenogram in any of these conditions. It is reasonable to suppose that it occurs, but conditions would indicate that it is extremely rare.

SUMMARY

Intracranial calcification consists of two types, physiologic and pathologic. The former includes such structures as the pineal gland, choroid plexus, falx cerebri and pacchionain bodies, which normally may exhibit varying amounts of calcium. The configuration assumed by calcification in these structures is more or less characteristic for each and can be differentiated roentgenographically.

Lesions which in the roentgenogram may exhibit areas of calcification include tumors, hematomas, tubercles, aneurysms, old abscesses, areas of old meningeal disease, and of old encephalitis. For practical consideration these may be divided into the neoplastic and non-neoplastic groups. Of the neoplastic group, calcification is most common in the glial tumors, endotheliomas (meningiomas), suprasellar cysts (Rathke's pouch tumors), hemangiomas, dermoids and cholesteatomas. Many of these tumors can be differentiated roentgenographically by the character of the resulting shadows.

In a series of 781 verified lesions of the brain observed at The Mayo Clinic, calcification within the lesion was observed by the roentgenologist in 7.6 per cent.*

* For discussion see page 628.

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Vol. XXIII, No. 6

CONGENITAL ANEMIAS, ROENTGENOLOGICALLY CONSIDERED*

By EDWARD C. VOGT, M.D., *and* LOUIS K. DIAMOND, M.D.
BOSTON, MASSACHUSETTS

IN THE past three years, we have observed 19 patients with severe anemia who have had distinctive bone changes in the roentgenogram. These cases may be divided into three groups, there being 5 cases of congenital hemolytic anemia (or congenital hemolytic jaundice), one case of sickle-cell anemia, and 13 cases of erythroblastic anemia. These conditions primarily involve the hematopoietic system, are congenital, as well as in some instances familial, and are chronic in course.

Congenital hemolytic anemia[4,6] is characterized by an increased fragility of the erythrocytes, associated with increased blood destruction, acholuric icterus, chronic anemia and splenomegaly. There is a marked tendency to remissions and exacerbations. The jaundice is persistent though it increases in intensity with the occurrence of hemolytic crises. As evidence of hemolysis there is an increase in the bilirubin content and the icteric index of the blood and an increase in the urobilin in urine and stools. Large numbers of reticulocytes (young erythrocytes) are found in stained smears and may constitute 30 to 90 per cent of the total red cells. This increase in reticulocytes is evidence of the great activity of the bone-marrow tissue.

FIG. 1. Advanced case of erythroblastic anemia with thick porous vault.

FIG. 2. Humerus and wrist of a moderately advanced case (post-mortem films). The circular defect in the upper end of the humerus is due to local invasion of the cortex by hyperplastic marrow tissue. The trabeculations of the metacarpals are prominent.

Sickle-cell anemia[3,8] derives its name from the characteristic sickle-shaped erythrocytes in the circulating blood. It occurs in persons with negro blood, is familial, and the course is likewise characterized by exacerbations and remissions. Hemolysis is marked during exacerbations, and is accompanied by jaundice, anemia and the other findings mentioned above under congenital hemolytic anemia. The peripheral blood here, too, shows large numbers of immature erythrocytes.

Erythroblastic anemia was first described by Cooley[1,2] who reported 7 cases of this disease in 1927. It occurs in chil-

* From the Departments of Medicine and Roentgenology of the Infant's and Children's Hospitals. Read at the Thirtieth Annual Meeting, American Roentgen Ray Society, New York City, Sept. 17–20, 1929.

Fig. 3. Lower extremities showing increased circumference of the shaft although the cortex is very thin.

dren of Mediterranean parentage, 11 of our 13 cases being of Greek ancestry. The familial incidence is illustrated by the occurrence of the disease in two brothers, two cousins, and one set of twins. The disease is associated with a severe anemia, a very large spleen, and a palpable liver. The name is applied on account of the presence of the great numbers of nucleated red blood cells, erythroblasts, in the peripheral blood. These, as in one of our cases, may number 300,000 per cu.mm.

From the above brief description of these conditions, it is evident that the common factor in each of the three diseases is hyperactivity of the bone-marrow tissue. This may be considered either as a physiological response of the tissue to the need for blood, or as a primary pathological process producing large numbers of abnormal erythrocytes. Especially does this conception seem to apply to erythroblastic anemia. The bone marrow, liver and spleen in this disease show over-crowding with erythrogenic centers just as the same organs in leucemia are involved in abnormal production of immature leucocytes.

These three groups have shown bone changes of varying degree, which may be interpreted as resulting from the same underlying morbid process, and in which the roentgenogram has proved a valuable diagnostic aid.

In speaking of roentgen evidence of bone changes in the congenital anemias we will refer chiefly to those seen in erythroblastic anemia in which the characteristic findings are most constant, but with the understanding that the same changes may be present in sickle-cell anemia and congenital hemolytic icterus, but usually to a less marked degree. As a result of hyperplasia of the marrow substance the medullary trabeculations stand out unusually prominently, not only in the diaphyses of the extremities and in the ribs, but particularly in the metacarpals and metatarsals. The cortex becomes thin and there is occasionally an area that appears to be punched out, due to localized invasion by marrow substance.

The changes in the roentgen appearance of the skull varies, of course, with the age of the patient and the severity of the disease. In early or mild cases there may be

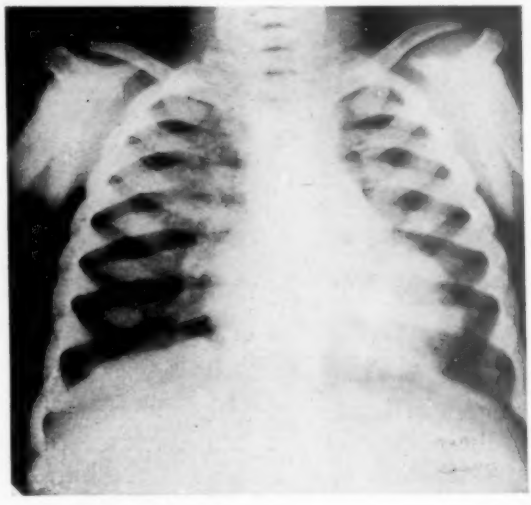

FIG. 4. Chest of same case as in Figure 1 showing broad porous ribs and moderately enlarged heart.

Fig. 5. Skull of pre-Columbian Maya, thick and porous.

only a slight thickening of the cranial vault and increased porosity. In advanced cases the depth of the bony structure is greatly increased while the outer table becomes so thin and porous that it cannot be detected as a distinct plane. The diploë are very prominent and seem to extend beyond the outer table. When seen in profile the surface appears to be studded with small radiating spicules, but where the exposure is made perpendicular to the plane of the skull it looks like a fine sponge.

We have spoken of these changes as being characteristic, not meaning that they are specific for congenital anemia, but we know of no other disease in living human beings* in which such a marked degree of marrow hyperplasia is attained. Nor does it seem likely that any difficulty should be encountered in differentiating the skull changes from the localized spicule formation occasionally seen with osteogenic sarcoma or meningioma.[5] We feel, therefore, that the roentgen picture has a special significance.

Our experience with roentgen treatment is limited to two cases of erythroblastic anemia. Unfortunately the reaction following irradiation over the spleen of one of our early cases was so severe that it was about three years before treatment was attempted in another case. The second case, one of infant twins, was also irradiated over the spleen but developed no untoward symptoms. Neither case showed any clinical improvement.

Numerous methods of treatment besides roentgen irradiation have been tried for these congenital anemias. Symptomatically the anemia may be relieved by one or more blood transfusions which in congenital hemolytic anemia and in sickle-cell anemia may tide the patient over until a remission occurs. Each of these types of cases has also been treated by splenectomy with the production of immediate remission which may be permanent. Erythroblastic anemia has not responded to any form of therapy. Splenectomy has been valueless in 4 cases. The feeding of liver extract and iron has likewise failed to produce more than a transitory change in the blood. Transfusion has been of temporary benefit only. The disease runs a chronic course until there is a fatal termination, either from the anemia or from an intercurrent infection.

* Williams[7] has described a "symmetrical osteoporosis" found in many skulls of pre-Columbian Peruvians and some North American Indians. Judging from the pathological descriptions these show identical bone changes. He also quotes other authors who found similar conditions in the skulls of ancient Egyptians, and one in a French child supposed to have been buried in the Gallo-Roman period.

We have examined skulls of pre-Columbian Mayas, removed from the sacred cenote of the Chi Chen Itzas of ancient Yucatan, roentgenograms of which correspond to those found in the congenital anemias.

Dr Ernest A. Hooton of the Peabody Museum, Cambridge, has described in detail his findings in the Maya Skulls. (To be published soon.)

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DISCUSSION ON PAPERS OF DRS. SOSMAN, DYKE, SCHREIBER, CAMP, AND VOGT AND DIAMOND

DR. SHERWOOD MOORE, St. Louis, Mo. Some eighteen months ago Dr. George Williams of the Department of Anatomy at Washington University Medical School in St. Louis, and late of Harvard University, submitted for my opinion the roentgenograms of some skulls which he had made of the Mayan Indian people in Yucatan. At that time, I could not give him any idea of what the nature of these bone changes were, but since then I have been on a still hunt for something parallel, bearing in mind the works of Cooley and Lee, Reynolds, and Costello, on skull changes in certain anemic conditions. Finally, there was an entry in the Hospital of a case of sickle-cell anemia, with the opportunity to carry out roentgen studies. In this case I found something comparable to the changes observed in the Mayan Indian skull and ventured the opinion that probably the same pathological process was the basis of the bone changes in both instances. Unfortunately, we have had but the one case of sickle-cell anemia and none of congenital hemolytic icterus for study. Only a roentgenogram of the Mayan Indian skull, and not the specimen itself, was submitted to me, but it is quite interesting. It is the skull of an adult. Its findings suggest an interesting point in paleopathology, that is, that possibly one of the reasons for the disappearance of the Mayan Indian was that they were generally affected by some anemic condition allied to those of congenital nature.

I would disagree with Dr. Diamond and Dr. Vogt in grouping congenital hemolytic icterus and sickle-cell anemia together. As far as roentgen changes in the bones constitute a guide for differentiation, which I believe they do, the two diseases are distinct, and I trust this will be shown in these slides.

(Slide) The first slide is of the skull which Dr. Williams submitted for my opinion, and you will see the close resemblance to the similar slide shown by Dr. Vogt. I know of no other bone lesion which produces just that condition in the skull.

(Slide) The second slide is from the case of sickle-cell anemia, which, by the way, was an adult male, twenty-seven years of age and in relatively good health.

(Slide) The third slide: These are the bones of the hand in the case of sickle-cell anemia, and I show them because the cortex in the long bones has so thickened that the medullary cavity has almost disappeared. The outline of the cavity has disappeared, not because of external overgrowth, but because of growth internally. I think that they are quite different from the changes in the long bones that were shown by the previous essayist. Furthermore, in adults we do not see the changes in the cancellous bone to which they referred.

(Slide) The fourth slide is of the bones of the feet, which show the identical change in the cortex and narrowing of the medullary canal without increase in size and without change in the cancellous bone.

(Slide) The fifth slide is of the bones of the forearm. They show narrowing of the medullary canal without external apposition of bone or increase in its volume. The other long bones, as far as we can make out, did not show such changes.

CHAIRMAN SOSMAN. We will now call on Dr. Holmes to show his interesting slide presumably of the same condition.

DR. GEORGE W. HOLMES, Boston. I am showing this slide more for historical interest and diagnosis than anything else. This slide was sent to me by Dr. Howard Ruggles of San Francisco about 1916, with a request that I help him in any way I could in making a diagnosis. I had never seen anything like it and wasn't able to give him any help, and our path-

ologist wasn't able to give me anything, so I put it away in my collection and it has been there every since. I think it must be one of the cases. I would like to have Dr. Vogt speak on it.

Dr. Vogt. I think it is evidently without doubt a similar condition, because in the erythroblastic anemia the changes are more marked than in any of the other two conditions, either congenital hemolytic icterus or sickle cell anemia. I would think this was a case of congenital anemia.

Dr. Henry K. Pancoast, Philadelphia. Dr. Sosman, who asked me to discuss the paper, has loaned me a slide for diagrammatic demonstration of three conditions, as follows:

(1) Most of us have probably noted in the vertex of the skull of many normal individuals a peculiar striated appearance. This faint striation extends through *all* of the tables, but not beyond them. The exact cause is unknown.

(2) In the condition that has just been discussed you will find the striation extending through the *outer* table particularly and for a considerable distance beyond.

(3) A third condition in which striation occurs in the tables of the skull and which is quite common, quite spectacular and with which we are all probably familiar is the so-called hyperostosis overlying meningioma and it is diagrammatically represented by a striation extending through *all* tables and beyond.

In a recent article, Kolodny has taken issue with some of the other authorities about this subject and has described the hyperostosis as a result of a stimulation through increased blood supply in the bone overlying the meningioma. He states that the solid hyperostosis first appears and the striation is a secondary change due to an invasion of the hyperostotic area by the meningioma cells. The meningioma cells have been found without any doubt by a number of observers, particularly by Cushing and Phemister.

The hyperostosis was not mentioned in connection with the classifications of the brain tumors. There are two very interesting types of hyperostosis in connection with meningioma —that which occurs in the vertex and that in the base of the skull. In the latter there is no striation as you see it in the vault, but it is a thickening of the bone which closely resembles in many cases the osteoma and no doubt has been diagnosed as osteoma very frequently. So far as we have been able to determine, no one has ever found meningioma cells in the hyperostosis of the base, with one exception. Quite recently Winckelman of Philadelphia has found a few cells in one basal hyperostosis. They are commonly found in the vault hyperostoses.

There is one other peculiar appearance of the skull which resembles a hyperostosis about which we knew but little until quite recently. It occurs in the frontal region, involves only the inner table as far as we can tell stereoscopically, has somewhat the appearance stereoscopically of the convolutional atrophy from pressure, but it is entirely localized. The first case we saw had an encephalographic examination made and air did not enter the pathways of this region but a subsequent examination showed that air did, and the condition was thus proved to be extradural. Dr. Frazier has operated on one case of this kind and Dr. Towne told me he had operated on two cases. Both of them found that this peculiar appearance was bony and that it involved the inner table only. Sections have shown that it is bone and is not a tumor. It is apparently not due to injury. It may occur in families. Dr. Frazier had another case of three members in one generation with exactly the same appearance.

Dr. R. R. Newell, San Francisco. I agree that calcification of the choroid plexus is not a very rare finding. I have seen one instance in which one choroid plexus was displaced visibly downward by pressure of a cerebral tumor. One must be careful not to mislead a neurologist consultant by the discovery of calcification in the hemisphere. We have two cases of that which was not the disease from which the man was suffering. In one case we found a calcification as big as the end of my finger in the right occipital lobe and operation disclosed a glioma in the left frontal lobe.

I have seen bone changes similar to those in the anemias which Dr. Vogt described in children, in a child suffering from lymphatic leucemia, with areas of bone absorption in the small bones of the hands and feet.

The disappearance of the Maya Indian was brought out in discussion. Perhaps such familial anemia has something to do with the Maya Indian. One geologist has brought out an interesting theory that the Maya Indian was practically shoved off the point of the Yucatan

Peninsula into the sea. On account of the geologic structure of the country, the water supply which was in pools near the surface has disappeared progressively from the base toward the tip of the peninsula. There is also archeological evidence that the Maya civilization moved from the base of the peninsula out toward the tip. This geologist offered as a theory then that the Maya Indian was crowded away slowly through generations by the disappearance of the water and he moved up the water as it appeared in front of him and was gradually pinched off by the disappearance of the water supply.

DR. JACOB VASTINE, Philadelphia. When Dr. Kinney and I first started this work in 1926 with the advice of Dr. Sosman, in measuring skulls to determine the usual position occupied by the pineal, there was a misgiving in our minds as to whether there was too great a personal equation entering into the measurements and whether this method used by us would be of value in hands other than our own. I was extremely gratified to see the close correspondence of the results of these other men with our results. They erased that objection from our minds and more firmly established the value of pineal displacement in the presence of intracranial lesions. Since making these examinations in 1926, I have been continuing to measure the skull cases coming under my attention and I still feel that the observations are the same as those made at that time. The displacement is not always pathognomonic of intracranial lesions since it is occasionally seen in apparently normal skulls, but it certainly, combined with the clinical findings, is of some value.

DR. DIAMOND (closing). The difficulties in separating the various splenomegalies with anemia that occur in childhood are well known. We have seen cases when, from the roentgen changes in the bones, or the presence of many immature cells in the blood smears, the diagnosis of leucemia has been made. In such cases, more careful consideration of the character of these blood changes, and the understanding of the bone changes discussed in this paper, has permitted us to make the diagnosis of a congenital anemia, of the erythroblastic, hemolytic, or sickle-cell type. Further clinical observation has always proved this to be correct.

DR. VOGT (closing). I was very much interested in the adult case of sickle-cell anemia that Dr. Moore showed. Our experience with congenital anemias is limited to children, but in them we are unable to detect any difference in the skeletal changes except as to degree.

Regarding leucemias, I think the bones might show similar changes if the patients lived long enough. Leucemia in childhood is usually quite rapidly fatal. Then too since the white cell elements of the marrow are particularly involved the changes should not be so striking as in the congenital anemias, where the abundant red cell elements become hyperplastic.

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VISUALIZATION OF THE INFUNDIBULUM AND THE PITUITARY GLAND*

CASE REPORT

By CHARLES WADSWORTH SCHWARTZ, M.D., *and* CORNELIUS GYSBERT DYKE, M.D.
NEW YORK CITY

WE BELIEVE that the pituitary gland and its pedicle can actually be visualized by ventriculography. Of course we realize that the structure and relationship of the normal brain and ventricles does not allow for this visualization. In order that the pituitary gland and its pedicle may be demonstrated, a high degree of internal hydrocephalus must be present with resultant dilatation and distortion of the third ventricle. We present the following case to demonstrate the structures under discussion:

CASE REPORT

Pain in the right side of the face and nape of the neck. Deafness in the right ear. Suboccipital craniotomy. Adhesive arachnoiditis disclosed.

August 6, 1929. Admission (N. Y. N. I. Hospital No. B18794M) of May M., a single, American female, aged twenty-seven, with the presumptive diagnosis of intracranial tumor.

Anamnesis. (Principal recorder Dr. E. Chesher.) The patient had meningitis at six years of age, following which she has had severe headaches every other day which are relieved by aspirin. She is deaf in her right ear and has had attacks of pain in the right side of her face for the past four months. These attacks occur three to five times per day and consist first of a crawling sensation followed by numbness and this is followed by severe pain in the right side of the face. These attacks last about ten minutes, and from these she can obtain no relief.

Examination revealed a well-developed and well-nourished female who appeared to be quite neurotic. She was deaf in the right ear. In addition there was a hypesthesia of the right cornea and diminished sensation of the right side of the face to cotton and pin prick. No thermal changes. There was 2 diopters choking in the right eye and 1 diopter in the left eye. The visual fields were concentrically contracted. She was discharged unimproved, Aug. 26, 1929.

She was readmitted to the hospital on November 7, 1929, at which time her complaints and physical findings were practically similar to those on her previous admission. Encephalography was performed on November 12, 1929. This showed most of the air to be collected at the cisterna magna, and only a very small amount was present over the cortex. This was apparently normally distributed. Ventriculography on November 22, 1929, revealed markedly dilated but symmetrical ventricles. The third ventricle was greatly dilated and appeared to be prolapsed about the infundibulum and the pituitary gland (Fig. 1). The Frazier method of ventriculography was used.

FIG. 1. Showing the infundibulum and the superior portion of the pituitary gland. In addition one can readily discern the anterior, middle and posterior commisures and also the anterior portion of the dilated aqueduct of Sylvius.

On December 2, 1929, a cerebellar craniotomy was performed and a chronic adhesive arachnoiditis was found. The patient had a rather prolonged and stormy convalescence and was discharged from the hospital on January29, 1930. At this time she had no headaches or pain

* From the Department of Roentgenology, New York Neurological Institute (Unit of the Medical Center), New York City.

in the face and the papilledema had disappeared. She was seen in the Surgical Follow-up Clinic on February 8, 1930, at which time she complained of considerable gastric distress, but no mention of the headaches or pain in the face was made by the patient. Examination of the decompression showed it to be soft and the choking of the discs was less than 1 diopter.

Discussion. In order to explain this condition we visited the Department of Pathology of the Presbyterian Hospital of New York, and reviewed several of Dr. Wilder Penfield's protocols and we wish to quote from two of them as follows:

"The third ventricle is much dilated and its floor is thinned out like a membrane. It pushes downward so as to be 2 or 3 cm. across in the infundibulum."* In another case he states, "The third ventricle is greatly dilated and its floor, which extends down into the sella, is about 5 mm. in thickness."† We have recently been able to observe, in one of our own cases which came to autopsy, a third ventricle which was markedly dilated and its floor was only 0.4 mm. in thickness. The floor of the third ventricle had been displaced into the sella turcica and the pituitary gland in this case was flattened.

* Autopsy 9743-N-2042.
† Autopsy 9788.

For these reasons we feel that it is possible for the infundibulum and the pituitary gland in part, to be visualized. This comes about when the floor of the third ventricle is membranous-like in thickness and is pushed downward around the infundibulum and hypophysis. In other words, there is a reduplication of the tuber cinereum around the infundibulum and the superior portion of the pituitary gland, so that we actually see the infundibulum, the reduplicated tuber cinereum and the superior portion of the pituitary gland itself.

Our ideas as to the anatomical arrangement which permits of the visualization of the infundibulum and pituitary gland are shown in the sketches (Figs. 2 and 3.)

CONCLUSIONS

The infundibulum of the pituitary gland may be demonstrated by ventriculography.

The superior portion of the pituitary gland may be visualized by ventriculography.

These structures become visible only when the changes described above have occurred.*

* We wish to express our appreciation to Dr. James W. Jobling for the privilege of using the protocols of the cases referred to above.

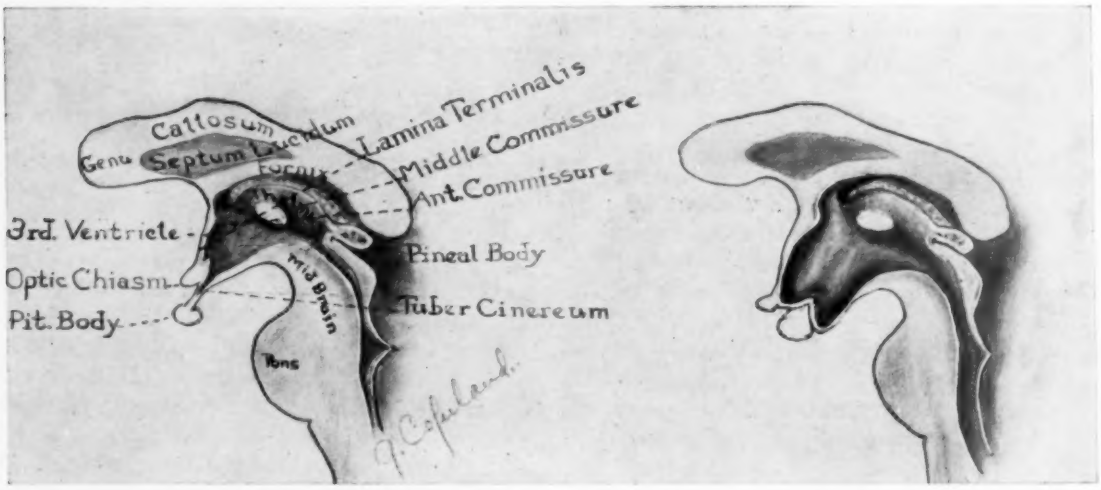

FIG. 2. Lateral view, showing the normal relationship of the third ventricle to the infundibulum and the pituitary gland.

FIG. 3. Lateral view, showing the abnormal relationship of the third ventricle when dilated, to the infundibulum and the pituitary gland.

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IMPROVED TECHNIQUE FOR THE USE OF HIGHLY FILTERED GAMMA RAYS IN THE TREATMENT OF CANCER OF THE MOUTH*

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IT WAS my privilege to present this subject first before the International Conference on Cancer held in London, July, 16–20, 1928, by invitation of the British Empire Cancer Campaign. Since then I have learned that a similar technique is being used in some of the mouth cases at the Radiumhemmet[1] in Stockholm, and at the Radium Institute in Paris. I have been using this technique for about four years, and it is only during this time that I have become enthusiastic over the treatment of cancer of the mouth. The improvement in results, and the almost complete absence of damage to the normal tissues is gratifying to both the patient and the radiologist. I feel certain that these results will instill hope in both physicians and patients and will lead to earlier treatment and correspondingly better results.

By highly filtered gamma rays, I mean the use of a filter equivalent to 3 or 4 mm. of lead. This will eliminate entirely the alpha and beta rays and about 25 per cent of the gamma rays. The relative filtration values of the various metals were given to me many years ago by the late Dr. Viol, of the Pittsburgh Radium Chemical Company, but are again quoted by Thoraeus,[5] from Meyer and Schweidler, "Radivaktivität" as follows:

Al	2.7	Cu	8.9
Zn	7.1	Ag	10.5
Steel	7.7	Pb	11.3
Brass	8.4	Au	19.3
Ni	8.8	Pt	21.4

Thoraeus also gives the relative filter value of lead in eliminating the softer gamma rays as follows:

Pb equivalent 1 mm. =0.90 i.e. 10% absorbed
Pb equivalent 2 mm. =0.82 i.e. 18% absorbed
Pb equivalent 3 mm. =0.75 i.e. 25% absorbed

We cannot, of course, remake all of our equipment, but much of it can be adapted if the principles and the relative values are kept in mind. For external packs, which are used at 4 or 5 cm. distance, we distribute radium needles contained in 3 mm. brass, or placed upon lead sufficient to build up the filter value. For use within the mouth, platinum or gold is more practical because less bulky, and will permit better control of the secondary radiation by means of one or more millimeters of rubber. For treatment within the mouth it is advisable to use as great a distance as is practical according to the location of the cancer, and then regulate the time according to the amount of radium, the distance, the filtration and the results that are to be produced. Since no two cancers are alike, the greater the experience, the better the judgment, and the greater the skill and fundamental knowledge of the principles of radiology, the better should be the results.

This improved technique is based upon two fundamental principles laid down by Regaud.[4] He recommends that their radiation be prolonged so as to destroy all of the cancer cells in the process of division, and says: "It is useless to expect to kill all of the cells of a squamous cell cancer; it is sufficient to kill the mother cells; the others which form practically the whole mass, disappear gradually by transformation and resorption." His idea, therefore, is that a moderate amount of radiation continued over a considerable time

* Read at the Fourteenth Annual Meeting, American Radium Society, Portland, Oregon, July 8–9, 1929.

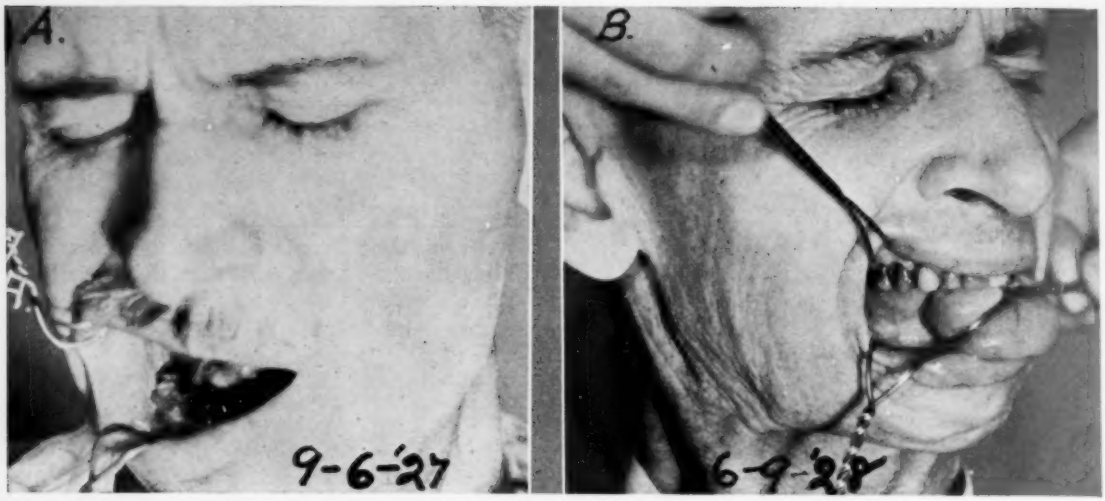

Fig. 1. A. Mr. F. P., aged forty-three, referred by Dr. S. I. Darnell, on Sept. 26, 1927, with carcinoma in the floor of the mouth involving the anterior two-thirds of the right inferior maxillary bone, making a tumor tissue mass 5 cm. in length, and 3 cm. in diameter, involving the floor of the mouth and extending out onto the cheek. It had been destroyed three months previously by electrocoagulation. No radiation treatment given. Prompt recurrence. B. Shows the same case entirely healed, June 7, 1928. Still well June, 1929.

is better than a great amount of radiation given in a short time. His second principle is indicated by the following: "As the radiation becomes more penetrating, the diffuse necrotizing effects diminish, then practically disappear, and finally only the selective effects remain which are manifested in the most radiosensitive cells, which are the cancer cells in the process of division." So far as I am aware, I was the first to have carried these two principles to such a high degree, namely, the filtration of the rays from radium through the equivalent of 3 or 4 mm. of lead and the prolongation of the effect during a period of three or four weeks. In this way one also combines the principle of the "saturation method" by keeping the irradiation up to the limit of normal tissue toleration for a considerable time.

GENERAL TECHNIQUE

For general surface applications, as a rule, we use the beeswax and hard wood powder compound which was developed at the Radium Institute in Paris, by Esquerra, Monod, and Richard.[2] We use 1 pound beeswax, 1 pound paraffin and 2 ounces hard wood powder. As a rule a thickness of 1 to 2 cm. is sufficient and the additional thickness is made up by felt. This material is melted and molded into plaques 15×33 cm. and 1 and 2 cm. in thickness. For use, this wax is softened in hot water and then molded to the part to be treated, and fixed by dipping in cold water. It is then built up to the desired thickness of 4 to 5 cm., by means of felt (or by blocks of cork as used at the Radium Institute). The radium is distributed over the surface in 5 mg. or 10 mg. units, according to the location of the disease and the effects to be produced. We usually use from 100 to 300 mg. on these packs. The surface is then covered with adhesive plaster, having the sticky surface outward. The radium units are then placed as desired and held in place by strips of adhesive plaster. The adhesive plaster is softened and removed, when desired, by means of carbon tetrachloride.

The wax mold permits the preparation of the radium packs for treatment of mouth cases with the least amount of

Fig. 2. A. Shows the carcinoma involving and having destroyed the bone down to the level of the inferior dental canal. The dotted outline and arrows indicate the involvement of the soft tissues. B. Shows the defect remaining in the bone, but the bone is healthy twenty-one months after the definite involvement by carcinoma.

exposure to the technician; they can be quickly applied and thus reduce exposure of the radiologist; and they are molded to the part, which assures their remaining in place and that the radium will always be kept at a constant distance. The packs are held in place by bandages and adhesive plaster. The packs have a disadvantage of being rather heavy. The weight can be reduced by using gold or platinum for filtration instead of brass or lead, but that increases the cost. Whenever it is practical we use felt alone and omit the wax, which also reduces the weight, but is only dependable when rather small, and flat surface packs are needed. Generally, we apply the radium to both sides because of the great tendency for mouth cancer (even cancer of the cheek) to spread to the opposite side. We usually use from 150 to 200 mg. to the affected side and 50 to 100 mg. to the opposite side, arranging it so that on the affected side the cross-fire effect will be greatest in the diseased area, and on the opposite side we center upon the most likely region of lymphatic extension. By means of these packs, we commonly use from 20,000 to 50,000 mg-hr. of surface irradiation. We have found that in this way we can give as our limit about 24,000 mg-hr. within two weeks and probably 36,000 mg-hr. within four weeks. We plan to give the radium treatment in about three or four weeks. During this period we give from 1000 to 3000 mg-hr. on the inside of the mouth and we interpose these local treatments between the radium pack periods, so that treatment is given nearly every day.

For *application inside the mouth* one must improvise appliances continually, so arranged that they will direct the radiation to the best advantage into the diseased tissue and at the same time *protect* the healthy tissue. For this purpose we use curved tubes to hold capsules against the pharynx, tonsil, and posterior surface of the tongue. At times a tonsil clamp can be used. Lead of $\frac{1}{8}$ inch thickness can be bent into the form of clasps, as recommended by Grier, to hold the radium in place, or dental compound may be used to make molds. Skill in making these applications is an important factor in the ultimate success. In all instances, the radium capsules and metal holders used inside the mouth must be protected by rubber, or damage will be done by secondary radiation from the metal.

Our best results have been obtained by surface application on the inside as well as outside, but when the disease is of long

duration or when there have been previous treatments and scar tissue formation, the induration does not always disappear, and one cannot be satisfied until it has

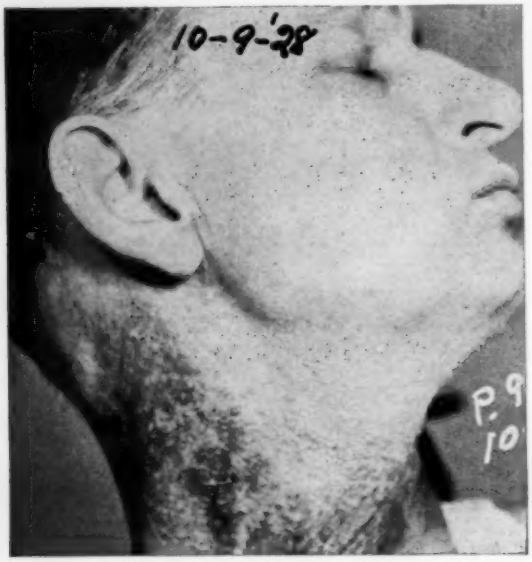

FIG. 3. Shows the absence of any damaging skin effects. The patient has had 23,000 mg-hr. of radiation externally, and 2,045 mg-hr. inside the mouth. This illustrates the value of the highly filtered gamma rays in the treatment of this disease, and recovery without damage to the tissues and with the preservation of the bone.

disappeared. After preliminary irradiation we sometimes remove these areas by the knife, by electrothermic methods, or we insert radium needles. When we use needles we prefer platinum-iridium of a filter value equivalent to 1 mm. lead, and 10 mg.

Under these circumstances we usually leave the needles in place from three to five hours. Even then at times we get troublesome necrosis. We make it a rule to apply surface applications, at least by packs, within a week after the needling, because of the associated congestion which followed needling, which may favor growth by increasing the blood supply to cancer cells.

When electrocoagulation is used, there is troublesome sloughing which gives much distress and annoying odors to the patient and the family. In the past, electrocoagulation, when associated with roentgen treatment, was an improvement over surgery alone, but now I am using it less and less in the mouth. Even with these massive treatments, by radium alone we have had no permanent damage to the skin or mucous membrane. There is usually scar tissue at the site of the lesion, and very rarely telangiectasis is noted. In some men there has been a return of the beard. There is always a temporary alopecia over the bearded area, and generally there is a temporary alopecia in the temporal regions. This latter condition we now try to prevent by protecting with $\frac{1}{8}$ inch (3 mm.) lead covered with 2 mm. rubber. We do not extend the radium above the zygoma, but unless prevented as directed the distant irradiation will produce a temporary alopecia extending about 7 to 8 cm. upward over the temporal region.

THE ADVANTAGES OF PURE GAMMA IRRADIATION

1. It is painless at the time of application, though it causes soreness and swelling in the mouth at the height of the radiation effect.
2. It requires no anesthetic.
3. It does not require hospitalization.
4. It produces no mutilation.
5. It usually produces no constitutional symptoms.
6. The skin effects, when carefully managed as directed above, are of no consequence.
7. In tongue cases, the function of the tongue is preserved.
8. It usually causes the disappearance of metastatic lymph nodes. When these are sluggish, we sometimes insert radium needles into the lymph nodes. If the glands break down they are removed surgically.

THE DISADVANTAGES OF PURE GAMMA IRRADIATION

1. It is exceedingly expensive, because one is using only a small portion of the total radiation.

2. It is not very practical to hire radium because one must pay while it is in transit.

3. A considerable quantity of radium must be available if one is treating a number of patients, and anyone who treats only a few patients generally lacks experience.

4. It interferes with the occupation of the patient during a period of at least a month.

5. It requires the constant or daily supervision of an experienced radiologist and cannot be turned over to technicians.

6. It requires the constant cooperation of the patient, which may be difficult to obtain.

7. The prolonged treatment which is necessary may be interrupted by ignorant patients, who do not appreciate the seriousness of the disease, or who consider themselves well prematurely.

8. The greatest possible precautions for self-protection must be taken by the radiologist and the technician because of the large amounts of radium which must be used.

ASSOCIATED TREATMENT

All patients with cancer of the mouth should have the following associated treatment:

1. A roentgen examination should be made of all of the teeth, and of the alveolar processes.

2. All diseased teeth should be removed, either at the beginning or as soon as sufficient radiation has been given to devitalize the cancer cells so that they will not be extended by the traumatism.

3. The mouth should be cleansed and kept clean. This will require much care and gentleness.

4. A complete blood count should be made at the beginning, and repeated from time to time during the treatment. If the patient is anemic, appropriate treatment must be instituted.

5. A Wassermann test should be made in most cases, for a large percentage of mouth cancers develop upon old syphilitic lesions. Therefore, the presence of a positive Wassermann test does not eliminate the diagnosis of cancer and should not delay the treatment. Likewise, a microscopical diagnosis of cancer does not eliminate the possibility of associated syphilis. Both a microscopical diagnosis and a Wassermann test are usually advisable in each case.

6. When a section is taken for microscopical examination, radiation treatment should be used either before or immediately afterward and should be continued until the lesion is proved not to be cancer, or until sufficient radiation has been used to cure the cancer. The fact that one considers a section necessary shows that cancer is a possibility. Under such management, with immediate associated irradiation, I have never seen any bad effects from taking a section.

7. The nourishment of the patients must be carefully provided for, otherwise they are likely to avoid food and lower their vitality.

RESULTS OF THIS TREATMENT

We have been using these methods less than four years and until the past eight months only in my private clinic. Recently, due to the generous gift from Col. Louis J. Kolb, I have been able to extend these methods at the Graduate Hospital. We have treated 94 cases by this method in private practice and 13 at the Graduate Hospital. Of the 94 patients treated at my private institute 50, or approximately 60 per cent, are either free from symptoms or are expected to recover, while 34, or about 40 per cent, are either dead or are expected to die. This is of no value whatever as statistical material, but after working with cancer of the mouth rather extensively for thirty-one years, I feel justified in recommending this technique. Previous to its use I had never seen carcinoma of bone disappear as the result of irradiation.

Quick[3] recently stated: "I have never seen squamous cell carcinoma secondary in the jaw bones controlled by radiation, except by resorting to the caustic effects of radiation." I have seen 6 cases in my own practice and 3 demonstrated by Dr. Gendreau at the Radium Institute in Montreal, in which such extensions were healed by surface irradiation. Therefore we have increased power by this technique.*

* For discussion, see page 653.

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RADIUM TREATMENT OF EPULIS*

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IT IS not without a certain degree of hesitancy that we assume to present so simple a topic as that of epulis. There is a fundamental reason, however, in that we believe the condition to be of sufficient importance to stress, because we have known it to be mistaken for a more serious lesion and often subjected to ineffectual or unnecessarily severe treatment.

Undoubtedly, many of the early cases of epulis fall into the hands of intelligent dentists who may successfully destroy them by cauterization methods before they reach the stage of cell organization and develop neoplastic tendencies. Those who have come to us for advice have stated that the condition is practically painless and the reason for their visit is that the growth, because of increased size, causes uncomfortable pressure symptoms or crowds the gum sufficiently to produce malalignment of the teeth, thus interfering with comfortable mastication. When this stage has been reached, local cauterization or local surgery usually fails to effect more than temporary relief.

There has been a difference of opinion among clinicians as to the pathological status of epulis. We ourselves, from a clinical standpoint, have never considered it malignant but believe it to be a low-grade neoplastic type of growth with giant cell tumor characteristics. One of our early patients, seen five or six years ago, came to us after a recurrence of an epulis and submitted two pathological reports for inspection. One pathologist named the growth removed "round cell sarcoma," and the other "giant cell sarcoma." The recurrence was quickly eliminated by radium and there has been no evidence of the growth since that time.

The name "epulis" is applied to the peculiar growth which generally appears as a red, pedunculated mass, growing from the alveolar process of the jaw, usually underneath the canine, bicuspid, or incisor teeth. It is covered with the mucous membrane of the mouth and is composed of fibrous tissue and giant cells. It is thought to develop from the periosteum in connection with the root of a decayed tooth (Adami) and appears as a periosteal giant cell tumor of the alveolus. At times the growth also appears around healthy teeth. The origin of the giant cells in epulis is a subject of much discussion, as pointed out by Ewing in his book on "Neoplastic Disease." Mallory holds that the giant cells of epulis are transformed wandering endothelial leucocytes and do not belong to the tumor process. Some believe that the giant cells are hypertrophied bone cells set free by absorption of bone matrix, while others think they are derived from modified endothelium, and have been classed with the angioblastic sarcomas.

In the cases of epulis which we have observed clinically there has been no evidence of metastasis. The response to irradiation has been complete in every instance although more rapid in some than in others. The tumors which responded more slowly were apparently of the fibrous type of epulis with few giant cells. The more vascular type was encountered in the majority of the cases. Seldom in the field of medicine do we meet with a condition where the response to treatment appears to be 100 per cent, but epulis seems to be one of these conditions. This growth is not infrequently seen in the oral cavity and is usually said to be a disease of childhood or early adult life. However, the majority of the 13 cases which we have observed were past forty years of age.

Epulis was treated by means of surgical excision before the advent of radium. In

* Read at the Fourteenth Annual Meeting, American Radium Society, Portland, Oregon, July 8–9, 1929.

The following is a brief review of the 9 cases which we have observed for more than two and one-half years, all of which are apparently entirely well.

Case	Age	Description of Lesion	Technique of Treatment	Time Elapsed Since Treatment	Result of Treatment
I	39	Rough, elevated, red area 0.5 cm. wide between upper rt. incisor and canine teeth. (Recurred after surgical removal.)	Radium 50 mg., 0.5 mm. silver, 1 mm. brass and 2 mm. rubber filter, applied against lesion 5 hours.	3 years, 1 month.	Lesion disappeared. No recurrence.
II	53	2 cm. wide mass, elevated and ulcerated, between upper incisor teeth. (Removed surgically 3 times previously.)	Radium 50 mg., 0.5 mm. silver, 1 mm. brass and 1 mm. rubber filter, applied against lesion 3 hours.	2 years, 10 months	Lesion disappeared. No recurrence.
III	45	Firm, bleeding mass 1 x 3 cm. in floor of mouth, connected with right lower gum.	*1st treatment:* Two 7.5 mg-el. needles, filtered by 0.15 mm. platinum-iridium (30%), plunged in lesion for 3 hours. *2d treatment:* 1 month later 50 mg. radium, 0.5 mm. silver, 1 mm. brass and 1 mm. rubber filter, applied against remainder 3 hours. *3d treatment:* 6 weeks later same dose as above applied.	2 years, 8 months	Lesion disappeared. No recurrence.
IV	41	Red, elevated papule between upper incisor teeth, 1 cm. wide.	Radium, 50 mg., 0.5 mm. silver and 2 mm. rubber filter, applied 3 hours.	4 years, 4 months.	Lesion disappeared. No recurrence.
V	38	Red, protruding mass 1 x 2 cm. in size between incisor and canine teeth left upper jaw. (Recurrence after surgical removal 3 months ago.)	One glass radon ampule containing 0.5 mc. inserted in center of lesion.	3 years, 6 months.	Lesion disappeared. No recurrence.
VI	42	Elevated mass 2 cm. wide beneath upper right canine tooth.	*1st treatment:* Two 7.5 mg-el. needles filtered by 0.15 mm. platinum-iridium (30%), plunged in lesion for 3 hours. *2d treatment:* 6 months later—still about half of original mass remaining which had started to grow again. One 0.5 mc. radon glass ampule injected.	5 years, 4 months.	Lesion disappeared. No recurrence.

Case	Age	Description of Lesion	Technique of Treatment	Time Elapsed Since Treatment	Result of Treatment
VII	25	Mass 2 x 2 cm. in size attached underneath upper incisor teeth. (Removed surgically once.)	*1st treatment:* Two 7.5 mg-el. needles filtered by 0.15 mm. platinum-iridium (30%), plunged in lesion for 4 hours, 15 minutes. *2d treatment:* 3 months later—one 50 mg. radium tube, 0.5 mm. silver and 2 mm. rubber filter, applied to lesion 2½ hours.	4 years, 4 months.	Lesion disappeared. No recurrence.
VIII	47	Irregular red mass 2 x 2.5 cm. in size attached to upper right alveolar margin underneath incisor and canine teeth. (Recurred after surgical removal.)	*1st treatment:* Two 7.5 mg-el. needles filtered by 0.15 mm. platinum-iridium (30%), plunged into growth for 5 hours. *2d treatment:* Above procedure repeated in 3 weeks. *3d treatment:* Same dosage applied 6 weeks later. Tumor mass was gradually reducing in size.	6 years, 10 months.	Lesion disappeared. No recurrence.
IX	50	Red, spongy mass between right upper 1st and 2d molars, 2 cm. wide. (Recurred after surgical removal.)	Radium 50 mg., 0.5 mm. silver and 1 mm. rubber filter applied against lesion 2½ hours.	7 years, 4 months.	Lesion disappeared. No recurrence.

the surgical treatment it was usually necessary to remove one or two teeth in order that the alveolar margin of the jaw could be removed. Such extensive surgical procedures frequently left deformities, especially in children. Very often oral surgeons would perform quite extensive operations for this simple condition, only to meet with recurrences later. In our series of 13 cases, 7 were recurrent after surgical removal. Some of these patients had been advised, after the recurrence appeared, to have radical operations with removal of teeth and extensive cauterization.

Of the 13 cases of this condition which we have treated, 2 are still under treatment and responding in the same satisfactory manner. Two other cases, recently treated, are apparently entirely well, one for four months and the other for six months. In both of these cases there was a complete disappearance of the growth after a single application of two 7.5 mg-el. needles, filtered by 0.15 mm. platinum iridium (30 per cent) for three and five hours respectively. The time elapsed since the treatment in the other 9 cases varies from two years and eight months to seven years and four months, and all are entirely free from recurrence at the present time. Two are well over two and one-half years, 2 over three years, 2 over four years, and 3 over five years. These cases will be reported in detail. Even the shortest period of elapsed time of two years and eight months is considerably longer than the average time of recurrence of a growth of this type.

After considering the technique of treatment in the cases of this series, it would seem that results were good regardless of

the particular technique used, as it varied in practically all of the cases. However, we believe that if it is possible to plunge two small needles (such as the 7.5 mg-el. needles filtered by 0.15 mm. platinum iridium (30 per cent) used in most of our cases) into the center of the tumor and follow this by a small dose of heavily filtered radium to the base of the lesion later, if necessary, good results may be obtained without fear of any tissue damage. A small dose should be used first and will probably suffice in most cases. By using the small platinum needles, sufficient dosage may be given in a short time and an accurate distribution of dosage obtained. In some of our cases there was a rapid shrinkage and almost entire disappearance of the mass after three or four days. It is usually not necessary to use even local anesthesia, as small needles may be inserted into the soft growth with practically no discomfort. In our cases there has been very little discomfort following the treatment.

The amount of radiation necessary to destroy an epulis is not sufficient to produce damage to the surrounding tissues if the radium is properly applied. By using small doses and combining the interstitial and heavily filtered surface applications, which we have just mentioned, we believe it is possible to successfully treat these growths without any fear of injury to the gums or teeth. We have not seen the slightest evidence of later irradiation changes or damage to the tissues in any of the epulis cases treated and observed over a period of years.

SUMMARY

1. Radium seems specific in the destruction of epulis.

2. Removal of teeth and extensive surgical destruction are unnecessary.

3. The technique of the radium application is simple and the treatment is successful in dosages which will not damage the teeth or gums.*

*For discussion see page 653.

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RADIUM IN THE TREATMENT OF TUMORS OF THE TONSIL*

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THIS paper is a brief report on the use of radium in 33 malignant new growths of the faucial tonsil. Twenty-seven were in males and 6 in females. The ages ranged from twenty-two to seventy-three years. There were 9 between the ages of forty and fifty, 10 between fifty and sixty, 11 between sixty and seventy and 2 between seventy and eighty years. There were 3 males and 3 females in the sarcoma group further classified as follows: 3 lymphosarcoma, 2 fibrosarcoma, and 1 perithelioma. A brief report of each case follows.

CASE I. Mrs. A. C., aged fifty-three, referred by Dr. Skinner, July 6, 1922, for treatment of a primary fibrosarcoma of the right tonsil as revealed by microscopical examination, grade 1. There were no enlarged glands in the neck. Platinum radium needles amounting to 200 mg-hr. were inserted into the primary tumor and a total irradiation of 20,000 mg-hr. externally was given. The primary lesion is replaced by a smooth soft scar. The patient is well seven years after initial treatment.

CASE II. Mrs. L. C., aged forty-nine, referred by Dr. E. Ross Faulkner, March 19, 1925, for treatment of tumor masses involving the posterior pillar of the left tonsil and lateral wall of pharynx. Two distinct hard tumor masses each 4×3×2 cm. were present. There was no ulceration or enlarged lymph nodes of the neck. A clinical diagnosis of fibrosarcoma was made. Ten glass implants 0.5 mc. each were inserted into the tumor area. Eight weeks later the masses had sloughed away. The condition has remained healed for more than four years. The lymph nodes in the neck although not palpable were irradiated.

CASE III. Mr. W. K., aged fifty-seven, referred by Dr. R. H. Fowler, September 11, 1924. Examination revealed a large tumor mass in the region of the left tonsil which had existed for about six months. A diagnosis of lymphosarcoma was made (grade 4). Seven 10 mg. radium needles were inserted into the mass for fifteen hours and 10,000 mg-hr. at 3 cm. distance was applied in divided doses to the left side of the neck. The local lesion disappeared two months after the initial treatment. The patient gained 15 pounds in weight and was apparently well for one year. He then started to lose weight and developed a cough and died six months later with metastasis to the chest. The roentgen examination of the lungs showed many dense rounded areas varying from the size of a pea to that of an orange.

CASE IV. Mrs. B. G., aged forty-one, referred by Dr. J. G. Dwyer, July 14, 1926, because of a firm hard non-ulcerated tumor mass in the left tonsil 6×4×3 cm. The condition began gradually several months before and when first seen by me she had considerable difficulty in swallowing and in talking. Two enlarged lymph nodes were made out at the angle of the jaw. A clinical diagnosis of lymphosarcoma was made. Only external radium treatments have been given in this case at 3 and 5 cm. distance amounting to 24,000 mg-hr. The metastatic nodes in left neck have disappeared and the primary lesion is one-third the original size. The patient is now clinically well three years after the first treatment.

CASE V. Mr. N., aged forty-five, referred by Dr. Henry M. Scheer, June 22, 1928, for radium treatment to lymph nodes of the neck. A few months before several large nodes appeared in left side of neck. An excision was made, and examination by Dr. Douglas Symmers showed the presence of a malignant tumor of the perithelioma type, the cells of which are arranged around blood vessels and springing, according to one view, from the perivascular lymph spaces and hence regarded as a perithelial endothelioma, and, according to another view, from the connective tissue of the blood vessels and hence regarded as a perithelial sarcoma. Microscopic examination of the accompanying lymph node, bearing the same serial number shows a simple hyperplastic lymphadenitis with no signs of metastasis. The tonsils were not enlarged but the left tonsil contained a definite hard nodule 1 cm. in diameter and was considered the primary lesion. Three 1

* Read at the Fourteenth Annual Meeting, American Radium Society, Portland, Oregon, July 8–9, 1929.

mc. gold implants were inserted into the tonsil neoplasm and 10,000 mg-hr. radium has been applied to the neck. The primary tumor has disappeared and also the infiltration in the left side of the neck.

CASE VI. Mr. J. P., aged twenty-two, was referred by Dr. E. C. Kern, June 8, 1928. A large tumor mass involved the left tonsil so that a tracheotomy was necessary in order to relieve the obstruction to breathing. There was no ulceration of the primary growth and no enlarged lymph nodes. The condition has existed for about three months. A clinical diagnosis of lymphosarcoma of the tonsil was made. Ten 1.0 mc. gold implants were inserted into the tumor mass and six treatments amounting to 14,000 mg-hr. of gamma radiation was given at 3 cm. distance to the left side of the neck. The tracheotomy tube was removed two weeks after the initial treatment and no evidence of the tumor can be made out one year later.

In *summarizing* the sarcoma group we find 2 patients well for five years, 1 for three years, 2 for one year and 1 dead with a metastasis to the lungs one and one-half years after the initial treatment.

In the epidermoid carcinoma group of 27 cases there were only 3 females. Brief case reports of these cases are as follows:

CASE VII. Mr. A. C., aged fifty-nine, referred by Dr. Thomas J. Harris, August 10, 1922. The chief complaints were sore throat, painful swallowing and loss of weight over a period of six months. Examination revealed an irregular, ulcerated, moth-eaten appearance of the entire right tonsil. There were no enlarged lymph nodes. The pathological report showed squamous cell carcinoma (grade 1). Platinum radium needles were inserted into the primary growth for 200 mg-hr. External irradiation was given to the right neck. He has remained well nearly seven years after initial treatment.

CASE VIII. Mr. J. R., aged sixty-five, referred by Dr. Lewis A. Coffin, November 29, 1922, for treatment of a large squamous cell carcinoma of right tonsil. The condition had been present for eight months but had been much worse for the past four weeks. The lesion was ulcerated and measured 6×4×1 cm. The lymph nodes in the neck were enlarged and firm. Seven platinum radium needles were inserted into the growth for 200 mg-hr. Radium packs at 3 cm. distance were applied to the metastatic nodes. Death occurred one year after treatment.

CASE IX. Mr. M. C., aged sixty-one, was referred by Dr. Lewis A. Coffin, March 3, 1923. For eight months the patient had had pain in right side of throat and difficulty in swallowing. Examination revealed a very advanced carcinomatous mass involving the right tonsil, soft palate and base of tongue. Large infected nodes were present in the right side of the neck. The primary growth was circumvalleted with platinum radium needles using 540 mg-hr. The glands in the neck were not favorably affected by radium packs. Later ulceration of these glands and extension of the growth to the pharynx resulted in death one year after the first irradiation.

CASE X. Miss E. S., aged fifty-nine, referred by Dr. C. H. Smith, August 15, 1923, for radium treatment of carcinoma of the right tonsil with metastatic nodes in neck. Sections revealed epidermoid carcinoma grade 3. Five 10 mg. platinum needles applied for eight hours eradicated the primary growth. The nodes disappeared under external treatment. The patient remained well for three years and did not report for examination. On February 8, 1927, she returned to the clinic with an extensive recurrence in the right tonsil with large metastatic nodes.

CASE XI. Mr. C. G., aged forty, referred by Dr. O. L. Munroe, October 29, 1923, for treatment of carcinoma involving the left tonsil and left side of the tongue. The growth was very extensive, cauliflower in appearance and ulcerated (grade 2). Enlarged lymph nodes were present in the neck. The patient received treatment for a period of six months, was lost track of but probably died within a year.

CASE XII. Mr. P. M., aged forty-six, referred by Dr. Weed, January 19, 1924, for treatment of a large growth involving the right tonsil and base of the tongue. Sections showed squamous cell carcinoma grade 3. There were large glands present in the right side of the neck. Eighty-five mg. in platinum radium needles were inserted into the base of the tongue and right tonsil region for six hours. The primary lesion in the tongue and tonsil cleared up, but the large infected lymph nodes in the neck became ulcerated and the patient died of hemorrhage,

December 1, 1925, twenty-two months after initial treatment.

Case XIII. Mr. J. McG., aged sixty-four, was referred by Dr. John Loré, February 21, 1924. The entire right tonsil including anterior and posterior pillars and base of the tongue was infiltrated with a large sloughing growth. The lymph nodes in the neck were involved. Seventy-five milligrams of radium in platinum needles were inserted into the growth for ten hours. Five months later the primary tumor had disappeared, a smooth soft scar replacing the growth. The metastases in the neck were not influenced by radium packs and the patient died after ten months.

Case XIV. Mr. P. K., aged sixty-two, referred by Dr. Linnahan, June 12, 1924, for treatment of squamous cell carcinoma in the left tonsil. Pain in the throat and difficulty in swallowing had existed for six months. Examination revealed a large ulceration of the left tonsil, soft palate and base of the tongue, with glands in the neck. The condition was improved under radium treatment for six months.

Case XV. Mr. A. L., aged sixty, referred by Dr. Robert C. Howard, October 16, 1924. There was an extensive growth of five months' duration which involved the entire right tonsil and base of the tongue. Extensive metastases invaded the lymph nodes on the right side of the neck. The patient had lost 17 lb. in weight. The primary lesion was not healed by the use of platinum radium needles and a fatal hemorrhage occurred April 1, 1925.

Case XVI. Mr. R. L., aged sixty-six, referred by Dr. Wm. L. Culbert, August 27, 1925. Examination showed very extensive sloughing squamous cell carcinoma of left tonsil with large metastatic nodes of the neck. The patient died December 11, 1925, from hemorrhage. The large sloughing growth did not heal following the insertion of platinum radium needles.

Case XVII. Mr. W. H., aged forty-three, referred by Dr. Arthur Wilson, October 7, 1925. For the past three months the patient had complained of sore throat and difficulty in swallowing which gradually grew worse. A large irregular growth involved the entire left tonsil and base of the tongue. There were no palpable lymph nodes. Section showed squamous cell epidermoid carcinoma (grade 4). The primary lesion was eradicated by use of platinum radium needles. Death occurred two and one-half years later with metastasis to the lumbar spine.

Case XVIII. Mr. P. P., aged forty-three, referred by Dr. O. L. Munroe, December 28, 1925, for radium treatment of a squamous cell carcinoma involving the right tonsil and base of the tongue (grade 4.) There were no enlarged nodes in the right neck. The mass in the tongue, however, was very extensive and was not removed by interstitial radium treatment. One hundred and twenty milligrams in twelve radium needles were applied for seven hours, and 12,500 mg-hr. applied to the right neck. The lesion in the tonsil disappeared but the malignant disease remained active in the base of tongue and right side of pharynx. The patient died nine months after initial treatment.

Case XIX. Mr. B. B., aged fifty-five, referred by Dr. John Loré, January 25, 1926, for treatment of a squamous cell carcinoma of the right tonsil and base of the tongue. The condition had existed for three months. Examination revealed an irregular papillary growth involving the right tonsil and extending to the side of the tongue. No enlarged lymph nodes in the neck were detected. The pathological report revealed squamous cell carcinoma (grade 2). Radium needles were inserted into the primary lesion amounting to 75 mg-hr. and 400 mg-hr. gamma radiation was applied as a surface application. Roentgen treatments have been given. He now is well two and one-half years after initial treatment.

Case XX. Mr. W. P., aged fifty-one, referred by Dr. Beaman Douglas, February 24, 1926. The patient's illness began ten months previously with soreness in the throat and difficulty in swallowing. The entire right tonsil was affected with a large ulcerated growth which extended to the side of the tongue. Several small glands were present in the right neck. The pathological report was squamous cell carcinoma, grade 2. Platinum radium needles were inserted into the tonsil and tongue neoplasm and radium packs amounting to 30,000 mg-hr. applied externally. This held the condition in check for two years, but he succumbed to recurrence and infection deep in the pharynx.

Case XXI. Mr. D. L., aged sixty-five, referred by Dr. W. W. Griffin, March 17, 1926, for treatment of a very large ulcerated squamous cell carcinoma, grade 4, involving the left ton-

sil and with nodes in the neck. Patient died nine months after initial treatment.

Case XXII. Mr. H.H., aged fifty-nine, referred by Dr. E. Ross Faulkner, March 31, 1926, for treatment of a large squamous cell carcinoma of left tonsil which had invaded the base of the tongue and lymph nodes of left side of neck (grade 3). The primary lesion was eradicated by the use of 10 mg. platinum needles inserted into the base of the growth for six hours. The metastatic nodes were retarded in growth for a few months by the use of 22,000 mg-hr. pack treatments. The patient died thirteen months after initial treatment with large infected mass remaining in the left side of the neck.

Case XXIII. Mr. J. N., aged seventy-one, referred by Dr. Arthur S. Wilson, April 29, 1926, for radium treatment of a large carcinomatous growth involving the left tonsil and left side of the cheek (grade 4). The condition was improved for a short time but the patient died of hemorrhage twenty-two months after initial treatment.

Case XXIV. Mr. A. B., aged sixty-two, was referred by Dr. Clarence H. Smith, March 21, 1927. The patient had a large tumor of the left tonsil which partially obstructed breathing. The condition had begun two years before. A large mass of lymph nodes was present on the left side of the neck. The tonsil tumor bled easily on manipulation and measured 7×5×5 cm. The largest node in left neck measured 10×7.5×5 cm. The primary tumor was eradicated by insertion of platinum radium needles, amounting to 600 mg-hr. Approximately 25,000 mg-hr. was given to the left side of the neck. He was much improved for one and one-half years and then began to lose weight rapidly and develop a cough with severe pain in chest. Roentgen examination by Dr. L. G. Cole revealed metastasis in the mediastinum and in the right lung field. The patient died December 25, 1928.

Case XXV. Mrs. M. H., aged fifty-eight, referred by Dr. Duncan MacPherson, April 25, 1927, for treatment of a growth in the right tonsil which had existed for five months. She thought the condition followed a severe cold and sore throat and had noticed a swollen gland in the right side of the neck. She suffered from diabetes. May 8, 1927, the right tonsil was removed and section showed epidermoid carcinoma, grade 4. There was a rapid recurrence in the surrounding tissue with increase in the metastatic nodes of neck. Eight gold radon implants, 1 mc. each, were inserted into the growth in the side of the pharynx. External radium packs were applied to the nodes of the neck. Three months after the initial treatment she appeared in good health with no evidence of neoplasm. On February 8, 1928, or nine months later, she was readmitted to hospital with a large tender swollen mass in the left side of the neck. The right tonsil area and right side of the neck appeared normal. The blood sugar showed 374 mg. per 100 c.c. The leucocyte count was 28,700 with 94 per cent polymorphonuclears. The red cell count was 4,700,000 and the hemoglobin 90 per cent. A diagnosis of cervical abscess was made. Operation was performed but no abscess cavity was found. The patient's condition became rapidly worse and death occurred the following day. Autospy revealed a large deep cervical abscess 3 cm. in diameter. Lymph nodes were removed from each side of neck but no evidence of malignancy was found. The tissue from the primary tumor area showed chronic fibrosis but no carcinoma.

Case XXVI. Mrs. J. P., aged seventy-three, referred by Dr. O. L. Munroe, May 4, 1927. For six months she had had sharp shooting pains in right ear at times and difficulty in swallowing for four months. A large ulcerated growth invaded the right tonsil. There were enlarged nodes in the neck. The base of the tongue did not appear to be involved. Electrocoagulation was used to remove the primary growth and gold radon implants were inserted into its base. Roentgen therapy was given to the right side of the neck. The primary lesion is healed and appears entirely well twenty-two months after the first treatment.

Case XXVII. Mr. A. F. J., aged forty-six, referred by Dr. J. Lobell, June 14, 1927. The examination revealed a most extensive growth involving the right tonsil and pharyngeal wall with massive glands in the right side of the neck. Section removed in March at the Huntington Memorial Hospital, Boston, showed squamous cell epidermoid carcinoma. Three roentgen treatments were given but the primary mass was not attacked. The condition had become so far advanced that only palliation could be expected. Four platinum implants were inserted into the tumor mass. Three radium packs

amounting to 15,000 mg-hr. caused some regression both in neck glands and primary tumor but it became necessary in November to perform a tracheotomy. The patient died in March, 1928.

Case xxviii. Mr. W. F. M., aged sixty-three, referred by Dr. Herman F. Lampe. During the last five months the patient had lost weight, had difficulty in swallowing and severe pain in the left side of the throat. The ulcerated growth involved the entire left tonsil, base of the tongue and hypopharynx. The patient's condition was improved for a few months but he died one year after initial treatment.

Case xxix. Mr. W. C., aged sixty-nine, referred by Dr. W. R. Brandon, July 8, 1927, for treatment of squamous cell carcinoma of left tonsil. No nodes were felt in the neck. Eight 1 mc. gold implants eradicated the primary growth. External treatment was applied. The patient is now well two years.

Case xxx. Mr. A. M., aged fifty-four, referred by Dr. Harmon Smith, October 24, 1927, for treatment of a large carcinomatous mass involving the left tonsil and the lateral half of tongue at the base (grade 3). Large nodes were present on the left side of the neck. Ten gold implants 1 mc. each were inserted into the growth in the tongue and tonsil. The nodes in the neck were surgically removed, followed by radium packs. Five months later there was no evidence of the primary growth but some infiltration existed in the left side of the neck. Recurrences in the base of the tongue again appeared and the patient died December 1, 1928.

Case xxxi. Mr. G. W., aged forty-seven, referred by Dr. Arthur Wilson, June 30, 1927, because of a large carcinoma which involved the right tonsil, right side of the pharynx and palate. Section revealed squamous cell carcinoma. The condition was improved for about one year by the use of gold implants and external packs, but a metastatic mass appeared on the left side of the neck and the patient died December 19, 1928.

Case xxxii. Mr. E. F., aged sixty-four, referred by Dr. Charles Byrd, December 15, 1927. A mass had appeared in the right tonsil nine months previously and now involved the right side of the tongue. Biopsy showed grade 4 carcinoma. No nodes were felt in neck. The primary lesion was eradicated by interstitial gold implants. The patient died September 1, 1928, from metastasis to the liver.

Case xxxiii. Mr. F. L., aged fifty-three, referred by Dr. Louis Hubert, January 9, 1928. Symptoms consisted of difficulty in swallowing, with pain in the throat shooting to ear for eight months. Examination revealed a very large growth involving left tonsil, left side of the palate and base of the tongue. There was a large hard mass of lymph nodes at the angle of the jaw. Section showed squamous cell carcinoma, grade 2. Eighteen 1 mc. gold implants have been inserted into the primary growth on three occasions and 40,000 mc-hr. have been applied externally. The primary lesion has disappeared, metastatic involvement is smaller but still present and active.

In the epidermoid carcinoma group of 27 malignant tumors of the tonsil, 1 patient is well seven years, 1 for two and one-half years, 2 for two years. Those who died lived for an average of twelve months after the initial treatment. Except in the most advanced cases, palliative relief was obtained for several months and was sufficient to justify the treatment.

The older technique of inserting platinum radium needles into the base of the primary lesion has been changed to the use of gold radon implants of 1.0 to 1.5 mc. with a 0.2 mm. wall thickness. The use of 2.0 to 2.5 mc. with a wall thickness of 0.3 mm. is even more desirable. One implant irradiates approximately 1 c.c. of tumor tissue. Interstitial radium treatment is the treatment of choice for the primary growths. External radium packs have been used in the treatment of the metastatic nodes of the neck. There were no clinical cures in those cases with palpable cervical metastatic lymph nodes.

According to Broders' gradation, of the 16 cases available for study, two were grade 1, four were grade 2, three were grade 3, seven were grade 4.

Malignant tumors of the tonsil should be recognized early but much delay may be occasioned by continued treatment for Vincent's angina, lues, and chronic tonsillitis. Biopsy is indicated in all cases of ulcerated lesions which do not respond easily to local treatment.*

* For discussion see page 653.

THE TREATMENT OF MALIGNANT TUMORS OF THE MOUTH AND THROAT*

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A NUMBER of therapeutic agents are at our disposal for the treatment of malignant tumors of the mouth and throat. The clinical value of some of these has been definitely proved, and others are still experimental. Among the former may be mentioned irradiation by radium and roentgen rays, and surgical procedures including excision either with the scalpel or some form of cautery knife, electrocoagulation and the actual cautery. The latter include lead and the various vaccines and serums. The selection of the proper agent or procedure, or the group of these to be used in a given case, is just as essential as correct methods of administration. Such selection is dependent on a number of factors, for example, the situation and extent of the lesion, its pathologic characteristics, whether or not it has been treated previously, and the age and general condition of the patient. Physicians are not entirely in agreement concerning the significance of these various factors or of the efficacy of the various therapeutic agents. I shall cite here only the conclusions arrived at through experience at The Mayo Clinic.

In general, lesions of areas readily accessible, as about the lips, should be removed surgically. Those involving areas difficult of access, as the nasopharynx and hypopharynx, should be destroyed with diathermy or treated with radium and roentgen rays. Low-grade epitheliomas and those of moderate activity should be excised or destroyed with diathermy or the actual cautery, and the regional lymph nodes removed subsequently. Very active epitheliomas and sarcomas should be irradiated. The primary lesion may be treated by radium in the form of a plaque or tubes on an applicator, in steel, platinum or radon points embedded in the growth and by radium packs or by deep roentgen rays over the lymph nodes. At times it is advantageous to supplement operation with irradiation, and vice versa. Carcinomas of mixed tumor type should be excised. Lesions previously treated, especially with irradiation, must be dealt with more radically and the prognosis in these cases is, as a rule, less satisfactory. Treatment should never be instituted until a diagnosis has been established. This will frequently necessitate biopsy.

The type of tumor and the rapidity of its growth are important considerations in determining the treatment advisable in a given case. Broders' method of grading carcinomas microscopically according to their activity, as evidenced by cell differentiation, has been of inestimable value from the standpoint of prognosis and treatment. This microscopic grading has, with few exceptions, corresponded strikingly with the clinical course of the disease. The slow-growing, mildly malignant lesions are graded 1 and the successively more active growths are graded 2, 3, and 4, respectively. Epitheliomas graded 4 are the most active and simulate sarcomas in their clinical behavior. They grow rapidly, widespread metastasis appears early, and recurrence is prone to be prompt following removal. In lesions graded 1 the local growth is, as a rule, readily controlled and lymphatic extension is not likely to occur. Lesions graded 1, 2 or 3, if surgical, should be excised or destroyed with the actual cautery, or electrocoagulation, and the regional lymph nodes removed subsequently. As a rule this procedure is carried out in the smaller epitheliomas graded 4, and inten-

* Read at the Fourteenth Annual Meeting, American Radium Society, Portland, Oregon, July 8–9, 1929.

sive irradiation is applied postoperatively. However, more reliance is placed on the radium and the roentgen rays. In extensive lesions of moderate activity, irradiation can often be used advantageously to supplement surgical measures. Likewise in dealing with highly malignant tumors, irradiation, which constitutes the major part of the treatment, may be applied to advantage following removal or destruction of all, or a portion, of the growth with electrocoagulation.

With few exceptions, the malignant tumors of the lips and cheeks are epitheliomas. Carcinomas, of mixed tumor type, occasionally develop in these areas. The epitheliomas in such areas vary greatly in degree of malignancy, being graded from 1 to 4. It has been the practice in the Clinic for a number of years to excise all such lesions, unless the extent of the growth, or the patient's age or general condition rendered this inadvisable. In this event, radium has been used either with the plaque, with platinum points, or with radon points locally, and surface irradiation of the submental and submaxillary areas. If the growth on the lip is extensive and involves the maxilla, wide excision by cautery is carried out and the surface of the bone, over the area of involvement, is thoroughly cauterized. The defect is left open, and plastic reconstruction deferred for from six months to a year. The submental and submaxillary lymph nodes, on either side, are excised in all surgical cases of carcinoma of the lip, unless there is some general contraindication; in malignant tumors of the cheek, unilateral dissection of the submental, submaxillary and upper cervical group of lymph nodes on the side of the lesion is done. If, on microscopic examination, the growth is found to have extended into any of these groups of lymph nodes, the next lower group in the neck, draining this area, is removed. The extensive block dissection, formerly carried out as a routine in the latter group of cases, has given way to this more conservative procedure. Without demonstrable lymphatic involvement, the prognosis for cure in carcinoma of the lip, with the foregoing treatment is approximately 90 per cent. If there is lymphatic involvement it is reduced at least 50 per cent in spite of the more extensive dissection of lymph nodes. Small superficial epitheliomas, inside the cheeks, may be excised with the cutting cautery or radioknife. As a rule, however, such lesions, as well as the extensive ones, are more readily and satisfactorily treated by diathermy. Radium is often used as an adjunct in these cases, seeds being inserted into the wound at the time of the operation, or the plaque or tubes are used later.

Malignant tumors of the jaws consist of epitheliomas, sarcomas of different types and adamantinomas. The epitheliomas vary in activity from the low-grade lesions developing in areas of papillary leucoplakia to the fulminating sarcoma-like tumors that become very large locally, ulcerate early, and metastasize extensively within the course of a few months. The clinical appearance presented by these lesions of varying activity is quite distinctive, although an accurate description of this difference is difficult. In general, the softer, more friable, and more vascular the lesion, the higher the grade of malignancy. Epitheliomas of the jaws are better treated by electrocoagulation, or the actual cautery, than by resection. Since the technique is much more simple, diathermy has largely supplanted the actual cautery in the treatment of these malignant tumors. Radon points are often inserted directly into the coagulated area immediately following diathermy. In the very active growths, more dependence is placed on such irradiation than on the diathermy, which is used chiefly to coagulate the tumor and its attachment, thus producing a dry, sterile bed into which the radon points may be inserted. In the low-grade epitheliomas, the actual cautery, or diathermy, is relied on almost entirely. The regional lymph nodes in such cases present much the same prob-

lems as in cases of epithelioma of the lip and cheek, although with the lesion confined to the alveolar process alone, metastasis is much less likely to occur than if the adjacent soft tissues are involved. The treatment of sarcomas is the same as that of the rapidly growing epitheliomas. Intensive external irradiation is always used in addition to local measures.

Adamantinomas, or adamantine epitheliomas, are multilocular and cystic, supposedly developing from remnants of the primitive dental enamel organ and occur, usually in the molar area, especially of the lower jaw. They are mildly malignant locally, being analogous in this regard to the basal-cell epitheliomas of the skin, and rarely metastasize. Although they usually grow slowly, they may become quite active. Sometimes they become huge, invade the skull, and cause death. Adamantinomas that are not too extensive are best taken care of with diathermy or resection. With the larger tumors of this type marked palliation may be obtained by drainage of the cysts followed by insertion of radium and irradiation externally.

Most of the malignant tumors of the body of the tongue are epitheliomas. They are, as a rule, easily recognized clinically. However, a small group of early lesions originating in inflammatory and traumatic ulcers, chronic thrush, and thickened leucoplakia, especially of the syphilitic type, do not, as a rule, present sufficiently characteristic features to permit of a definite diagnosis without microscopic examination. In such cases, there should be no hesitancy on the part of the physician either to excise the entire lesion, or, if it is extensive, to remove a specimen for examination. The common practice of treating such clinically indeterminate lesions with silver nitrate, radium, and so forth, adds to the difficulty of diagnosis and is resulting in a larger percentage of lesions progressing to the point where treatment is of little if any avail. In recently treated lesions, not only of the tongue, but of other portions of the mouth and throat, the appearance often will be so masked that biopsy or observation for a considerable period alone will enable one to recognize the condition. It is altogether inexcusable to treat any lesion of this region without first making every possible effort to establish a diagnosis.

Surgical lesions of the tongue may be excised sharply, or with some form of cautery knife. Often radium seeds are inserted into the open wound, prior to suturing. Closure of the wound following excision, either sharply or with the cutting cautery, is usually followed by primary healing. If radon points are inserted, the wound frequently will open later. If the growth on the tongue is extensive, or if the floor of the mouth is involved, surgical diathermy is, as a rule, preferable to excision. This procedure is bloodless, although there is increased danger of secondary hemorrhage on separation of the slough. Radon points are frequently used to supplement destruction with diathermy, especially in the more active lesions. Cases of carcinoma of the tongue that are not surgical are best treated with radon or platinum points. Some of these lesions respond remarkably well to this type of treatment, and, in some instances, growths that had appeared beyond help from any therapeutic measure have remained cured for several years. Besides the local treatment of these extensive growths, external irradiation is given over the regional lymph nodes. In the cases treated surgically, as soon as the condition of the wound in the tongue permits, bilateral, submental and submaxillary dissection, with block dissection on the side of involvement, is done if the patient's general condition warrants. If the patient is not a good surgical risk, more conservative dissection of the lymph nodes is carried out. Radium is sometimes implanted into the wound at operation and intensive, external irradiation administered subsequently when extension into the lymph nodes is demonstrated.

The tumors of the pharynx and tonsils

are, in general, highly malignant epitheliomas and lymphosarcomas. A small percentage are mixed tumors, sarcomas of special type and epitheliomas of low grade. Any of these neoplasms may be primary in the tonsils or in the adjacent tissues. It is often difficult to determine definitely regarding this. However, the treatment is much the same for either group. The more inactive epitheliomas should be destroyed with diathermy and radon points or 1 mg. platinum points immediately inserted into the base of the coagulated area. The regional lymph nodes are then removed, either by cautery or by sharp dissection, supplemented by surface irradiation. In the more active lesions, radon points are sometimes implanted into the metastatic nodes directly through the intact skin or following surgical exposure. The highly malignant epitheliomas and lymphosarcomas are most satisfactorily treated with radium inserted directly into the growth, or applied over its surface, and surface packs or deep roentgen rays used externally. Many of these patients do very well, particularly if the lymphosarcomas are of a fulminating type and have been present for only a few weeks. Fibrosarcomas may be treated in the same manner, although the response to treatment is, as a rule, less satisfactory. Mixed tumors in this region are entirely different from the growths just mentioned. They are encapsulated, grow slowly and do not ulcerate or infiltrate the surrounding tissues until late in the course of the disease. Metastasis does not occur until their retaining capsule has been ruptured. Such tumors should be removed surgically, either through the mouth or by external incision. Treatment of the lymph nodes is not necessary, provided the tumor has been enucleated without rupture of its capsule. In this event, also, the prognosis is good. Radium is placed directly into the wound if there is any question regarding the clean removal of the growth and radium or deep roentgen rays used over the outside subsequently. If infiltration of the surrounding tissues has occurred, radon points and external irradiation will accomplish more than surgical procedures.

In recent years New has directed attention to malignant tumors of the nasopharynx. His contributions have greatly extended knowledge on the subject and are leading to earlier recognition of these lesions not only by the otolaryngologist, but by the internist. On account of the anatomy of this region, these neoplasms produce a characteristic syndrome which is quite constant. Many of them early create more or less complete occlusion of the eustachian orifice, with resulting subjective symptoms of the ear, roaring noises, deafness, and pain in the ear being frequently complained of. Because of the proximity of the ninth, tenth, eleventh, and twelfth cranial nerves and the cervical sympathetic nerves, neurologic symptoms are common. Ocular disturbances likewise develop early. The most constant of these is paralysis of the external rectus muscle due to involvement of the sixth cranial nerve. Because of the highly malignant character of most of the tumors in this region, metastasis, as a rule, takes place early, the upper, deep jugular nodes first showing evidence of extension. The characteristic syndrome can, in most cases, be elicited readily with a carefully taken history and, of itself, often permits of a fairly accurate diagnosis. The outstanding symptoms are: pain in one side of the head, usually a continuous aching, worse at night and localized to the frontal and temporal region or deep in the ear; the appearance of a mass in the upper cervical area, and diplopia. Symptoms referable to the nose and throat are, contrary to common belief, quite infrequent and develop late. Because of the highly malignant character of these lesions, together with their inaccessibility, radium and deep roentgen therapy is the treatment of choice. Radium is applied directly to the tumor in the nasopharynx by means of a lead applicator, and external irradiation is given

with surface packs or with roentgen rays. By this means, marked palliation, and sometimes apparent cure, can be produced even in cases of extensive growths.

Fibromas of the nasopharynx, while microscopically benign, are clinically malignant, and should be considered along with the frankly malignant tumors of this region. They do not metastasize but they may, because of their situation, produce severe symptoms and even death. In 1924 a report of the treatment of the fibromas of the nasopharynx in The Mayo Clinic was presented before this society.[3] In this report it was pointed out that of 5 patients with nasopharyngeal fibroma, operated on by the avulsion method between 1910 and 1915, 2 died, whereas of 23 patients treated with radium between 1915 and 1923, 15 were well, 4 were still under treatment, and 4 were not traced; there was no mortality. The radium was applied directly to the surface of the tumor, by means of a lead applicator, or was implanted into it in the form of seeds or steel points, and surface packs used externally. Since 1923, this type of treatment has been used in a number of additional cases of fibroma of the nasopharynx with equally satisfactory results. Recently, however, it has been supplanted to a great extent by electrocoagulation.

The tumors of the base of the tongue and hypopharynx are largely active epitheliomas. Lymphosarcomas and adenocarcinomas are occasionally encountered in this situation. Formerly, all of the active malignant tumors in this region were treated by radium. In a few instances, when the cases warranted it, the regional lymph nodes were excised. Recently some of these tumors have been destroyed with diathermy supplemented by radon points. Low-grade fibrosarcomas have been removed from the hypopharynx through lateral pharyngotomy. The results in a few of the cases taken care of in this way have been very gratifying. Most of the patients with low-grade malignant tumors, in this region, especially adenocarcinomas, do not come under observation sufficiently early to permit of surgical removal, and radon points, together with external irradiation, must be resorted to.

Lesions in the pyriform fossa and postcricoid region are chiefly high-grade epitheliomas, and those in the pyriform fossa particularly metastasize so early that therapeutic measures are rarely curative. In the Clinic these have been treated entirely with radium and deep roentgen rays as in the preceding group. A number of attempts at surgical removal have been made, but the results have rarely been successful. In the lesions of the postcricoid region treatment has been most unsatisfactory, due to the activity of the growth, its inaccessibility, and the fact that only a small portion of it is visible on examination. Trotter has done commendable pioneer work in removing such growths by pharyngotomy. Some of his patients have remained well for more than two years.

Carcinoma of the larynx is not now considered the hopeless ailment that it was formerly. With the development of radium therapy, it was hoped that a method of treatment had been found which would cope with the condition successfully. That irradiation has failed to fulfill expectations in this regard is quite generally conceded. Many eminent radiologists have given up treating these cases and are referring them to the surgeon. If the lesion is recognized early, that is, when it is still confined to one vocal cord and is not fixed, exposure through laryngofissure and wide excision or destruction of the growth with diathermy, under direct view, will frequently result in cure, and leave the patient with a fairly normal voice. If, however, the growth involves both sides of the larynx, or extends onto the arytenoid on one side, or on both sides, laryngectomy will be necessary. In spite of the fact that many of these tumors are highly malignant, this will frequently cure them, because of the slowness with

which the cartilaginous wall of the voice box is perforated, and the poor connection between the lymphatic vessels internal and external to the larynx. This operation, although it deprives the patient of his normal voice and necessitates breathing through the tracheal opening in front of the neck, yet permits him to lead a fairly normal life. Most of these patients readily learn to use one of the artificial voice boxes now on the market and with the aid of this they are able to carry on their usual occupation with comparatively little inconvenience.

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DISCUSSION ON PAPERS OF DRS. PFAHLER, SOILAND AND COSTOLOW, ROBINSON, AND FIGI

Dr. W. Herbert McGuffin, Calgary, Alta. To me Dr. Pfahler's method is new and I hope to hear of his further results in the treatment of his patients. The technique seems ideal and if the results warrant the method, the procedure should become more general. The only disturbing factor is that many men do not have the same quantity of radium to work with as Dr. Pfahler. I would like to know whether Dr. Pfahler removes the teeth in the neighborhood of the diseased area before or after the radium treatment for carcinoma.

Dr. Soiland stated that he did not find the teeth devitalized following radiation therapy for epulis. That has not been my experience. We usually find them devitalized, and to overcome this we use a small amount of radium repeated at frequent intervals until the pathological condition is eradicated. In our work the majority of cases of epulis have occurred in pregnant women. I would like to know if this was true in Dr. Soiland's cases.

I believe every infected tonsil should be removed irrespective of age. Often we can shrink down the tonsillar tissue by irradiation but frequently we find it necessary to operate at a later date and then we encounter a pocket of pus behind the tonsil base. In malignancy of the tonsil I still think it might be well to remove the tonsil if at all possible. It can be removed by means of the electrothermic snare with very little traumatism, no bleeding and very little danger of dissemination of cancer cells to other parts of the body. After removal we can pack radium into the tonsil bed and apply the usual external irradiation.

Dr. Figi's paper was an excellent résumé of oral malignancy. I fully agree with him that biopsy should be made whenever possible. In regard to the care of the lymphatic glands of the neck, I have been advising the surgeon to do a complete resection of the glands of the neck in all cases of malignancy of the mouth, from three to four weeks following the radiation treatment of the local lesion. A further radiation treatment is given to the neck after the operation wound has healed. In the deeply infiltrating type of lower lip malignancy, we clean up the infection, treat the local area with radium and the neck by medium voltage roentgen rays, then ask the surgeon to do a complete resection of the lymph glands of the neck. This msy seem radical but we have to date some 200 cases on our records and the results warrant the carrying on of this treatment.

In cancer of the tongue I have been advocating the electrothermic removal of the growth, followed by radium treatment in the form of packs and needles to the affected area. A number of the patients so treated are now well over a period of years.

In carcinoma of the larynx I favor laryngectomy. In one case we treated by irradiation we produced so much irritation we had to do a tracheotomy and later still a gastrostomy in order to feed the patient. This patient is now

living after three years. Her voice is fairly good and she has no pain. This result was obtained only after a long stormy course and I feel that a laryngectomy would have been the more satisfactory treatment.

At this juncture I wish to sound a warning,—I do not believe it is good practice to follow radiation treatment by electrocoagulation. In my opinion the electrothermic knife is a cleaner and more satisfactory method if electrothermic surgical intervention is to be considered at all.

DR. SANFORD WITHERS, Denver, Colo. In treating most buccal cases, I have gotten away from the wax masks (which I used for a considerable time) and I am using the subcutaneous tissue itself. Instead of blocking the radium away from the skin, I am introducing the radium needles under the skin of the areas overlying and adjacent to the lymphatic glands in the neck. Carcinomas of the cheek, base of tongue, and floor of mouth, are blocked off into 1.5 cm. squares. Five milligram needles are then introduced into the tissue at the corners of these squares and left in position from twenty to thirty hours. Such tissues will usually stand a dose of from 100 to 150 mg-hr. per sq. cm. of surface treated. This amount of radiation should give from 100 to 120 per cent of an erythema dose. But this does not check very closely with the butter method used by Mrs. Quimby.

Dr. Robinson showed some excellent results and a very clear presentation of the pathology and dosage. I noticed, however, that he reported no cure of carcinoma of the tonsil in which there were cervical metastases. I wonder if this is not due to the fact that he does not treat far enough away from the primary growth. More than 50 per cent of carcinomas of the tonsil show a high grade of malignancy (grade 3 or 4) and these growths metastasize early to distant lymphatics. I believe that Dr. Robinson's results could be improved by giving the patient more widespread irradiation by radium packs and well-filtered roentgen rays.

I was interested in the paper on epulis, and I agree with Dr. Soiland that any case that goes three years without recurrence may well be considered as cured. I do not use highly filtered radiation for the treatment of epulis because it requires long treatment and in my hands it does not cause a complete retrogression of the growth, leaving a small tab of fibrotic tissue. Moreover the effect of irradiation upon the peridental structures results in the loss of irradiated teeth within eight to eighteen months. I usually remove these growths with cautery dissection, placing beta radiation at the base, and in this way I do not cause destruction of the peridental tissues.

DR. HENRY J. ULLMANN, Santa Barbara, Calif. Dr. Pfahler spoke of epilation from short wave radiation. In 1922, at a meeting of the American Roentgen Ray Society, during a discussion, I presented a physical hypothesis from which we should expect a different result with very short and very long wave radiation and quoted Coliez on the clinical side. I have made the statement many times that I have never seen permanent epilation from high voltage copper filtered radiation. I believe Dr. Pfahler's statement is further evidence that there is a definite difference in effect between long and short waves.

I usually fulgurate an epulis. So far, I have had very few cases. One extended from the inner side through between two molar teeth. It would have been very difficult to place an implant that would not injure the teeth and I had great difficulty in fulgurating without damaging either tooth.

Dr. Pfahler spoke of the difficulties of placing radium in dental compound molds. I found some years ago that the use of a dental drill with burr just the right size for the needle used made the work very simple and rapid. A larger burr can be obtained which is just the right size for the 50 mg. tube.

DR. H. H. BOWING, Rochester, Minn. I am sure we were all well pleased with the good results obtained by Dr. Pfahler and the method he employs. His technique or a similar one is deserving of our best efforts. To me the important treatment factors are: (1) multiple low intensity tubes; (2) highly filtered radiation; (3) rather long treatment time. My experience which I offer to further substantiate the report made by Dr. Pfahler has taught me that a method of employing these factors is worthy of being adopted by all radiotherapists. For more than ten years I have observed cases treated by what may be considered a similar method. The procedure is a conservative one. For example, it is my policy to divide the treatment field into small areas measuring about 4 cm. square. It is important to be certain that the field

mapped out extends well beyond the actual tumor site. As a rule from two to four areas are treated at a time. The time of application varies from twelve to fourteen hours, and the treatments are usually continued until all the fields have been covered. The treatment factors employed are as follows: A universal tube applicator containing 50 mg. radium element filtered through the wall of the applicator of 0.5 mm. silver, 1 mm. brass, and 2 mm. lead, maintained at a distance of 2.5 cm. by the interposition of the balsa wood block, the base of which measures about 4 cm. square. This technique may produce an erythema, but it is only mild and Dodd's lotion is usually recommended as a post-treatment preparation to be applied to the treatment field night and morning. At the time the treatment is outlined the marks are made directly on the skin with an indelible pencil, and a record of these areas is kept on a treatment card suitable for filing. In this way all chance of error is avoided.

Dr. R. E. Loucks, Detroit, Mich. I do not think enough emphasis has been placed on mouth hygiene. No doubt all of you practice it, but I think in the treatment of oral conditions it is exceedingly important. I use for sterilization, hexylresorcinol. This can be used in full strength after irradiation, and I dry out the cavity and apply mercurochrome.

I find it very easy in using modelling compound if you get some of the dental trays, take an impression of the area and then take the dental burr and drill locations in which to lay in any implants you wish and wherever necessary. Then use ordinary dental wax for protection.

Dr. Pfahler (closing). Regarding removal of the teeth, I stated in my paper that all teeth should be removed, either at the beginning of treatment or after a few days' preliminary irradiation to devitalize the cancer cells.

With regard to the details of technique, I gave them all in my paper in a general way. You cannot treat every case as I treat them, but I gave the general principles. Inside the mouth the distance variation is probably from 1 to 10 mm., depending upon the size of the place you have to work in. When you make applications inside the mouth you have to take not only the distance from the cancer but the distance of the other tissues, or you will do more harm than good. In carcinoma at the base of the tongue we cover the area externally from the zygoma to the base of the neck, and posteriorly from the mastoid to the region approximately of the canine teeth. I arrange the radium around the outside, so that I get the cone of radium toward the lesion. I get as far away as I can but try not to overlap in the center or I will get too much.

There are two objects in using the wax mould. One is that it adds to the filtration and increases the depth irradiation. Second, you form an exact model of the area you are treating and can keep the radium at exactly the same distance from the part. I know of no other way in which this can be done. In treating cancer of one side of the tongue or the mouth the great tendency is for the growth to extend to the other side. In cancer of the base of the tongue, the gland most likely to be involved on the opposite side is the pretonsillar gland. Therefore, we apply a circular felt pack, 4 mm. thick to the opposite side and that can be held in place and does not bind up the patient so heavily, but if you use the loose packs with mouth lesions in general you just fool yourself.

We use about 24,000 mg-hr. within about three weeks, using three-fifths on the affected side, and two-fifths on the opposite side, approximately. From a practical clinical experience in former physical measures I have learned that I can give about 24,000 mg-hr. by the technique I have described, and then produce deep erythema of the skin with desquamation afterward. Both sides must be treated.

I stated in my paper that all packs have been made up with 10 mg. units, and I said that I usually place 150 mg., which means fifteen of these units on the affected side at uniform distances around the periphery, so that the irradiation is centered as it comes together. It comes together with the greatest intensity at the tumor area. Roughly, the field would be about 4×6 inches, but it must be varied in shape according to the area you are working with. I do not believe we can ever lay down any definite technique for everyone to use in every case.

As to the question of different biological effects from radium or roentgen rays, there has been a great deal of talk about the radiation being the same, and that it is entirely a matter of delivering quantity and depth value. I do not believe this. Even in the work done by Friedrich, he showed that the biological effect

from the same intensity is about three times as much for radium as for roentgen rays. I do not believe there is any difference except for intensity between radiation filtered through 3 mm. Al and 6 mm. Al. It is simply a matter of intensity, but after passing radium rays through 3 or 4 mm. lead there is certainly a difference in the biological effect, as compared with roentgen rays through a few millimeters of aluminum.

Dr. Orville N. Meland, Los Angeles, Calif. (closing discussion for Dr. Soiland). Regarding Dr. McGuffin's remark, so far as we know none of the teeth in our cases were devitalized, and for that reason we made the statement that it did not devitalize the teeth. The technique varied. We made use of some beta radiation when we plunged needles into the growth, but gamma radiation was used as a surface application in the cases that had previously been treated surgically. They had to have further treatment, some as many as three or four applications.

The purpose of the paper is to controvert the usual teaching found in surgical textbooks, and the teaching in dental schools, that in cases of epulis one must sacrifice the teeth and do a radical excision and extraction in order to eradicate the disease.

Dr. Robinson (closing). The removal of a malignant tonsil by excision with electrothermic methods has the objection that it leaves no place to apply the radium implants. The interstitial method permits even distribution of radiation and at a considerable distance from the periosteum.

In the application of radium packs to the regional nodes, a plaque 5 by 7.5 cm., at a distance of 3 cm., 3000 mg-hr. with screenage of 0.2 mm. platinum, 1 mm. brass and 1 mm. lead gives an erythema dose. At 5 cm. distance 10,000 mg-hr. may be employed.

Dr. Figi (closing). The last word has, of course, not yet been said concerning the treatment of malignant tumors of the mouth and throat, and in appearing here for presentation of this subject more from a surgical standpoint I realized that our opinions regarding treatment would differ.

I enjoyed Dr. Pfahler's paper, and wish to congratulate him on the results he has presented. I should like to express agreement with what he said about the value of irradiation over surgery in the treatment of extrinsic carcinoma of the larynx. We, too, have seen much more satisfactory results in the extrinsic group following intensive irradiation than with radical surgery.

Dr. McGuffin's statement concerning his treatment of the glands of the neck in cases of carcinoma of the mouth interested me very much, since it corresponds with the treatment we have been carrying out routinely in these cases at the Clinic.

Vol. XXIII, No. 6

THE AMERICAN JOURNAL OF ROENTGENOLOGY AND RADIUM THERAPY

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Publisher: Charles C. Thomas, Springfield, Ill.

Issued Monthly. Subscription $10.00 per year, $11.00 in Canada and $12.00 in foreign countries. Advertising rates submitted on application. Editorial office, 110 Professional Building, Detroit, Mich. Office of publication, 220 E. Monroe St., Springfield. Ill. Information of interest to all readers will be found on page iv.

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EDITORIAL

INTRAVENOUS PYELOGRAPHY

PERHAPS in no branch of medicine has greater progress been made in diagnosis than in the field of the genitourinary diseases. With the aid of the cystoscope and the roentgen ray, and the employment of pyelographic media first reported by Voelcker and Lichtenberg,[1] the skilled urologist has achieved a diagnostic accuracy which is perhaps unsurpassed.

While cystoscopic and pyelographic examinations are of tremendous importance, they are not without certain drawbacks and limitations. Technically, except in the hands of the most skilled, ureteral catheterization is at times difficult and subjects the patient to pain and occasionally to serious reactions. Osborne, Sutherland, Scholl and Rowntree,[2] realizing the need for a more simple and painless method of exploring the urinary tract, first suggested in 1923 the oral and intravenous administration of sodium iodide as a means of depicting the urinary tract roentgenographically. They hoped by this method to obviate the necessity in many cases of a cystoscopic examination. The thought which prompted the use of this method was the fact that dermatologists were giving large doses of sodium iodide without any harmful effects; as much as 10 gm. could be given to practically every patient without any untoward symptoms, provided the injection was not made too rapidly. It was found that satisfactory roentgenograms of the bladder were secured in practically every case with doses of from 5 to 20 gm. intravenously, while 10 gm. of the sodium iodide intravenously gave fair roentgenograms of the kidneys and ureters in approximately 50 per cent of the cases and occasionally the liver and spleen were visualized. They also made the observation that the time elapsing between the administration of the sodium iodide and the taking of the roentgenograms is of vital importance owing to the rapidity of the urinary excretion of the iodide. The best roentgenograms which they obtained were taken one-half, one and two to three hours after doses of 5, 10 and 20 gm. respectively. These observations were based on the actual determination of the rate of excretion of the sodium iodide.

While satisfactory roentgenograms of the kidney, ureters and bladder were obtained, the results were not comparable to those obtained by the usual pyelographic examination and consequently this method was not pursued further. They suggested, however, that these investigations might serve as stepping stones to other fields of study and in this they were not mistaken as the publication of their work was soon followed by the studies of Volkmann[1] (1924) who experimented with various substances including lithium iodide and the bromide as well as the iodide of sodium, and from these studies he also concluded that sodium iodide was the preparation of choice, his findings being comparable to those of Osborne, Sutherland, Scholl and Rowntree. Also in 1924 Rosenstein and von Lichtenberg reported work with iodide in conjunction with the perirenal pneumoradiographic method of

[1] Voelcker, F., and Lichtenberg, A. Pyelographie (Roentgenographie des Nierenbeckens nach Kollargolfüllung). *Munchen. med Wchnschr.*, 1906, *53*, 105–107.

[2] Osborne, E. D., Sutherland, C. G., Scholl, A. J., Jr., and Rowntree, L. G. Roentgenography of urinary tract during excretion of sodium iodid. *J. Am. M. Ass.*, 1923, *80*, 368–373.

[1] Volkmann, Joh. Zur röntgenographischen Darstellung der Harnwege durch intravenöse Verabreichung schattengebender Mittel. *Deutsche med. Wchnschr.*, 1924, *50*, 1413–1414.

Rosenstein. Lenarduzzi and Pecco[1] in 1927 on the basis of animal experimentation with sodium iodide obtained good roentgenograms of the kidney pelvis after the ligation of the ureters. Finally Roseno and Jepkins,[2] in 1929, conceived the idea of combining sodium iodide with urea and in numerous experiments on dogs found that the intravenous injection of sodium iodide in conjunction with urea produced a contrast medium which was satisfactory enough to visualize the kidney pelvis. In the first animal experiments the ureters were ligated so as to produce a slower excretion of the urine but later this was replaced by a preliminary subcutaneous injection of morphine which exercised an inhibiting effect upon the bladder musculature. The addition of the urea, because of its diuretic effect, besides acting as a vehicle for the iodide, accelerated the excretion of the contrast medium through the kidney, leading to a greater concentration and thus to a better visualization of the kidney pelvis. The resulting roentgenograms were more satisfactory both from a technical and clinical standpoint than any that had been previously reported and the method was extended to humans.

Roseno[3] in the clinical application of these studies to humans concluded that intravenous pyelography is of great advantage in all those instances in which the usual pyelographic examination is contraindicated, as for example, ureteral stricture, atrophy and tuberculosis of the bladder, occlusion of one of the ureters or tuberculosis of the kidney. It was observed that there were reactions in some of the cases following the intravenous administration of their preparation. These reactions manifested themselves as a sensation of pressure in the head and occasionally in the chest, associated with a feeling of faintness such as observed following the injection of calcium salts. There were at times evidences of headache with a slight elevation of temperature which lasted for about twenty-four hours. Within forty-eight hours all reactive symptoms had disappeared. The normal pyelogram obtained after intravenous injection with the contrast medium differed from that obtained after the retrograde injection in that it appeared smaller and less distorted. Roseno attributed this difference in size to the fact that mechanical distortion is entirely absent in intravenous pyelography. He concluded from his studies that intravenous pyelography with iodine-urea gives a method of functional kidney diagnosis, at the same time permitting visualization of the entire excretory urinary paths. In his first publications Roseno did not give the exact nature of the solution which he employed but he later called the preparation "pyelognost."[1]

Swick[2] in November, 1929, reported a new preparation called "uroselectan" for intravenous pyelography. This was developed by Binz and Räth from a compound called selectan neutral which had been used in the treatment of coccus infections of various types. The good results obtained in infections of the gallbladder and urinary tract made it seem probable that the excretion of selectan neutral was chiefly through these two tracts, a fact which led to the investigation of its value for the roentgen visualization of the biliary and urinary tracts. Uroselectan proved entirely harmless, of good solubility, was excreted by the kidney in a sufficient concentration to produce good roentgen visibility, and was excreted in its entirety in a short while following its administration.

[1] Lenarduzzi, G., and Pecco, R. Iniezioni endovenose di ioduro di sodio (ricerche radiol sperimentali). *Arch. di radiol.*, 1927, *3*, 1055–1060.

[2] Roseno, A., and Jepkens, H. Intravenous pyelography. *Fortschr. a. d. Geb. d. Röntgenstrahlen*, May, 1929, *39*, 859–863.

[3] Roseno, A. Die intravenöse Pyelographie. II. Mitteilung. Klinische Ergebnisse. *Klin. Wchnschr.*, June 18, 1929, *8*, 1165–1170.

[1] Roseno, A. Die intravenöse Pyelographie. *Klin. Wchnschr.*, Aug. 27, 1929, *8*, 1623.

[2] Swick, M. Darstellung der Niere und Harnwege im Röntgenbild durch intravenöse Einbringung eines neuen Kontraststoffes, des Uroselectans. *Klin. Wchnschr.*, Nov. 5, 1929, *8*, 2087–2089.

Later von Lichtenberg and Swick[1] and more recently Swick[2] in continuing the work with uroselectan reported favorably on its use and concluded that intravenous pyelography by means of uroselectan is of considerable value in the diagnosis of all urologic conditions, and moreover that it permits the elaboration of new methods for the estimation of the functional disturbances of the kidney.

Other investigators[3,4,5,6,7,8,9] have continued the studies with uroselectan, all of whom report favorble results with its use.

This new method employed in the study of the genitourinary tract is too recent to permit of any accurate conclusions, but by its use pyelography will undoubtedly be greatly simplified and with this simplification there will be a possibility of earlier studies in renal, ureteral and a vesical disturbances, and it also opens up a new approach to the study of the physiology of the kidneys and ureters.

Although the introduction of intravenous pyelography in the diagnosis of genitourinary conditions will simplify the technique of examination, it may add considerably to the difficulty of interpretation and will place on the examiner a greater responsibility in the proper interpretation and utilization of the information gained by this method of study.*

[1] von Lichtenberg, A., and Swick, M. Klinische Prüfung des Uroselectans, *Klin. Wchnschr.*, Nov. 5, 1929, *8*, 2089–2091.

[2] Swick, M. Intravenous urography by means of uroselectan. *Am. J. Surg.*, Feb., 1930, *8*, 405–414.

[3] Kielleuthner. Ueber eine neue aussichtsreiche Untersuchungsmethode an den Harnorganen (Uroselektan). *München. med. Wchnschr.*, Feb. 14, 1930, *77*, 276–278.

[4] Bergerhoff, W. Intravenous injection of contrast medium for pyelography; significance of this method for internal medicine. *Med. Klin.*, Feb. 14, 1930, *26*, 232.

[5] Béclère, H., Porcher, P., and Henry, Robert. Premiers résultats de la methode de Lichtenberg. (Pyélo-urétero-cystographie par injection intra-veineuse). *Bull. et mém. Soc. de radiol. méd. de France*, Feb., 1930, *18*, 79–81.

[6] Vallery-Radot, Pasteur, Dalsace, Jean; Nemours-Auguste and Derot, Maurice. Nouveau procédé d'exploration radiologique des voies urinaires. *Presse méd.*, March 19, 1930, *38*, 385–387.

[7] Ravasini and Gortan. Il quadro radiografico delle vie urinarie mediante l'iniezione endovenosa con l'uroselectan. *Radiol. med.*, March, 1930, *17*, 327–328.

[8] Roth, E. J. H., and Wright, H. W. S. Intravenous pyelography. *Brit. M. J.*, Apr. 26, 1930, *1*, 778–780.

[9] Truchot. Présentation de quelques radiographies du système urinaire, obtenues après injection intra-veineuse d'urosélectan. *Bull. et mém. Soc. de radiol. méd. de France*, April, 1930, *18*, 171–173.

* For a review of recent literature on the subject of intravenous pyelography, see the abstract section in this number, beginning with page 685.

SOCIETY PROCEEDINGS, CORRESPONDENCE AND NEWS ITEMS

Items for this section solicited promptly after the events to which they refer.

MEETINGS OF ROENTGEN SOCIETIES*

UNITED STATES OF AMERICA

AMERICAN ROENTGEN RAY SOCIETY
Secretary, Dr. John T. Murphy, 421 Michigan St., Toledo, Ohio.
Thirty-first annual meeting: West Baden Springs Hotel, West Baden, Indiana, Sept. 23–26, 1930.

AMERICAN COLLEGE OF RADIOLOGY
Secretary, Dr. Albert Soiland, 1407 S. Hope St., Los Angeles. Calif.
Annual Meeting, Detroit, Mich., 1930.

SECTION ON RADIOLOGY, AMERICAN MEDICAL ASSOCIATION
Secretary, Dr. G. W. Grier, Jenkins Arcade, Pittsburgh, Pa.
Annual meeting, Detroit, Mich., June 23–27, 1930.

RADIOLOGICAL SOCIETY OF NORTH AMERICA
Secretary, Dr. I. S. Trostler, 812 Marshall Field Annex, Chicago, Ill.
Sixteenth annual session: Los Angeles, Calif., Dec. 1–5, 1930.

RADIOLOGICAL SECTION, LOS ANGELES COUNTY MEDICAL SOCIETY
Secretary, Dr. Orville N. Meland, 1407 S. Hope St., Los Angeles.
Meets on the third Wednesday of each month at the California Hospital.

RADIOLOGICAL SECTION, SOUTHERN MEDICAL ASSOCIATION
Secretary, Dr. W. S. Lawrence, Medical Arts Bldg., Memphis, Tenn.

BUFFALO RADIOLOGICAL SOCIETY
Secretary-Treasurer, Dr. Joseph S. Gian-Franceschi, 610 Niagara St.
Meets second Monday of each month except during the summer months, the place of meeting to be selected by the host.

CHICAGO ROENTGEN SOCIETY
Secretary, Dr. Robert A. Arens, Michael Reese Hospital.
Meets monthly on second Thursday from October to May (except during month of December) at Virginia Hotel. Dinner at 6 P.M., scientific session at 8 P.M.

CLEVELAND RADIOLOGICAL SOCIETY
Secretary, Dr. Harry L. Farmer, 2930 Prospect Ave.
Meetings are held at 6 o'clock at the University Club on the fourth Monday evening of each month from September to April, inclusive.

DETROIT ROENTGEN RAY AND RADIUM SOCIETY
Secretary, Dr. O. J. Shore, Fisher Building,
Meets monthly on first Thursday from October to May, at Wayne County Medical Society Building.

CENTRAL ILLINOIS RADIOLOGICAL SOCIETY
Secretary. Dr. H. C. Kariher, Decatur, Illinois.
Regular meetings held quarterly.

INDIANA ROENTGEN SOCIETY
Secretary, Dr. J. N. Collins, Indianapolis, Ind.
Annual meeting each February 22 in Indianapolis.

MILWAUKEE ROENTGEN RAY SOCIETY
Secretary, Dr. J. E. Habbe, 221 Wisconsin Ave., Milwaukee.
Meets first Friday in October, December, February and April.
Place of meeting designated by the president.

MINNESOTA RADIOLOGICAL SOCIETY
Secretary, Dr. L, G. Rigler, University Hospital, Minneapolis, Minn.
Next meeting Duluth, Minn., July 14, 1930.

NEW ENGLAND ROENTGEN RAY SOCIETY
Secretary, Dr. Thomas R. Healy, 370 Marlboro St., Boston. Mass,
Meets monthly on third Friday, Boston Medical Library.

NEW YORK ROENTGEN SOCIETY
Secretary, Dr Robert E. Pound, Fifth Avenue Hospital.
Meets monthly on third Monday, New York Academy of Medicine.

CENTRAL NEW YORK ROENTGEN RAY SOCIETY
Secretary, Dr. D. S. Childs, 316 Gurney Bldg., Syracuse, N. Y. Three meetings a year—April, August and November.

PACIFIC COAST ROENTGEN RAY SOCIETY
Secretary, Dr. Harold B. Thompson, Seattle, Wash.
Two meetings a year.

PENNSYLVANIA RADIOLOGICAL SOCIETY
Secretary, Dr W. E. Reiley, Clearfield, Penna.
Two meetings a year, April and October.

* Secretaries of societies not here listed are requested to send the necessary information to the Editor.

PHILADELPHIA ROENTGEN RAY SOCIETY
Secretary Dr. John T. Farrell, Jr., 235 S. 15th St., Philadelphia.
Meets monthly on first Thursday evening, Pennsylvania Hospital.

ROCHESTER ROENTGEN RAY SOCIETY, ROCHESTER, N. Y.
Secretary, Dr. James M. Flynn, 282 Alexander St.
Meets monthly on the first Friday evening at 7:45 at the Rochester Medical Association Building.

ST. LOUIS ROENTGEN CLUB
Secretary-Treasurer, Dr. L. R. Sante, Missouri Building
Meets first week of each month. Time and place of meetings designated by president.

TEXAS RADIOLOGICAL SOCIETY
Secretary-Treasurer, Dr. C. P. Harris, Houston, Texas.
Meets annually one day preceding the meeting of the Texas State Medical Association.

UNIVERSITY OF MICHIGAN ROENTGEN RAY SOCIETY
Secretary, Dr. D. M. Clark, University Hospital, Ann Arbor, Mich.
Meets every Wednesday evening from September to July, at 7:30 o'clock in the amphitheatre of the University Hospital.

VIRGINIA ROENTGEN RAY CLUB
Secretary, Dr. Wright Clarkson, 205 S. Sycamore St., Petersburg, Va.

CUBA

SOCIEDAD CUBANA DE RADIOLOGIA Y FISIOTERAPIA
Secretary, Dr. Francisco Padron, Enrique Villuendas 64, Havana, Cuba. Meets monthly in Havana.

BRITISH EMPIRE

BRITISH INSTITUTE OF RADIOLOGY INCORPORATED WITH THE RÖNTGEN SOCIETY
Meets on the third Thursday of each month, from November to June inclusive, at 8:15 P.M., at 32 Welbeck St., London, W. 1., or as advertised.

ELECTRO-THERAPEUTIC SECTION OF THE ROYAL SOCIETY OF MEDICINE (CONFINED TO MEDICAL MEMBERS)
Meets on the third Friday of each month during the winter at 8:30 P.M. at the Royal Society of Medicine, 1 Wimpole St., London, W. 1.

SECTION OF RADIOLOGY AND MEDICAL ELECTRICITY, AUSTRALASIAN MEDICAL CONGRESS
Secretary, Dr. H. M. Cutler, 139 Macquarie St., Sydney, New South Wales.

RADIOLOGICAL SECTION OF THE VICTORIAN BRANCH OF THE BRITISH MEDICAL ASSOCIATION
Secretary, Dr. Colin Macdonald, Lister House, 61 Collins St., Melbourne, Australia.
Meets monthly at Melbourne during the winter.

SECTION ON RADIOLOGY, CANADIAN MEDICAL ASSOCIATION
Secretary, Dr. A. H. Rolph, 160 St. George St., Toronto, Ont.

RADIOLOGICAL SECTION, NEW ZEALAND BRITISH MEDICAL ASSOCIATION
Secretary, Dr. P. C. Fenwick, The Hospital, Christ-church.
Meets annually.

CONTINENTAL EUROPE

BELGIAN SOCIETY OF ROENTGENOLOGY
Secretary, Dr. J. Boine, Avenue des Alliés, 134, Louvain (Belgium).
Meets monthly on second Sunday at d'Egmonds Palace, Brussels, except in the summertime.

SOCIETE DE RADIOLOGIE MÉDICALE DE FRANCE
Meets monthly on second Tuesday, except during months of August and September, 12 Rue de Seine, Paris.

SOCIÉTÉ SUISSE DE RADIOLOGIE (SCHWEIZERISCHE RÖNTGEN-GESELLSCHAFT)
Secretary for French language, Dr. A. Grosjean, La Chaux de Fonds.
Secretary for German language, Dr. Scheurer, Molzgasse, Biel.
Meets annually in different cities.

SOCIÉTÉ FRANCAISE D'ELECTROTHÉRAPIE ET DE RADIOLOGIE MÉDICALE
Meets monthly on fourth Tuesday, except during months of August and September, 12 Rue de Seine, Paris.

ASSOCIATION OF GERMAN ROENTGENOLOGISTS AND RADIOLOGISTS IN CZECHO-SLOVAKIA
Secretary, Dr. Walter Altschul, German University, Prague, II/52.

DEUTSCHE RÖNTGEN-GESELLSCHAFT (GE SELLSCHAFT FÜR RONTGENKUNDE UND STRAHLENFORSCHUNG)
Meets annually in April, alternating one year in Berlin, one year in some other German city. Meets in addition every two years with the Gesellschaft deutscher Naturforscher und Aerzte.
Permanent secretary, Professor Dr. Haenisch, Klopstockstrasse 10, Hamburg, Germany.

SUD- UND WESTDEUTSCHE RÖNTGENGESELLSCHAFT
Meets annually in different cities.

NORD- UND OSTDEUTSCHE RÖENTGENGESELLSCHAFT
Meets annually in different cities.

DUTCH SOCIETY OF ELECTROLOGY AND ROENTGENOLOGY
Holds two meetings a year in Amsterdam, one in the Spring, and one in the Fall.

SOCIETA ITALIANA RADIOLOGIA MEDICA
Secretary, Professor M. Ponzio, University of Turin, Turin.

SOCIETATEA ROMANA DE RADIOLOGIE SI ELECTROLOGIE
Secretary, Dr. Nicolae Busila, 44 Elizabeta Blvd., Bucarest.
Meets second Monday in every month with the exception of July and August.

ALL-RUSSIAN ROENTGEN RAY ASSOCIATION, LENINGRAD, USSR in the State Institute of Roentgenology and Radiology, 6 Roentgen St.
Secretaries, Drs. S. A. Reinberg and S. G. Simonson.
Meets annually.

LENINGRAD ROENTGEN RAY SOCIETY
Secretaries, Drs. S. G. Simonson and G. A. Gusterin.
Meets monthly on the first Monday at 8 o'clock in the State Institute of Roentgenology and Radiology, Leningrad.

MOSCOW ROENTGEN RAY SOCIETY
Secretaries, Drs. L. L. Holst, A. W. Ssamygin and S. T. Konobejevsky.
Meets monthly on the first Monday at 8 o'clock, the place of meeting being selected by the Society.

POLISH SOCIETY OF RADIOLOGY
Secretary, Dr. A. Elektorowicz, 19 Hoza St., Warsaw.
Meets annually.

WARSAW SECTION, POLISH SOCIETY OF RADIOLOGY
Secretary, Dr. B. Krynski, 11 Zielna St.
Meets once a month except in the summertime.

SCANDINAVIAN ROENTGEN SOCIETIES
The Scandinavian roentgen societies have formed a joint association called the Northern Association for Medical Radiology, meeting every second year in the different countries belonging to the Association. Each of the following societies, with the exception of the Denmark Society, meets every second month except in the summertime:

SOCIETY OF MEDICAL RADIOLOGY OF SWEDEN
Meets in Stockholm.

SOCIETY OF MEDICAL RADIOLOGY IN NORWAY
Meets in Oslo.

SOCIETY OF MEDICAL RADIOLOGY IN DENMARK
Secretary, Dr. O. Wissing, Copenhagen.
Meets on the second Wednesday of each month from October to July in Copenhagen, at 8 o'clock in the State Institute of Roentgenology.

SOCIETY OF MEDICAL RADIOLOGY IN FINLAND
Meets in Helsingfors.

VIENNA SOCIETY OF ROENTGENOLOGY
Secretary, Professor Holzknecht, Vienna, IX, General Hospital.
Meets on the first Tuesday of each month from October to July.

ASSOCIATION OF GERMAN ROENTGENOLOGISTS AND RADIOLOGISTS

The Seventh Meeting of the Association of German Roentgenologists and Radiologists in the Czechoslovakian Republic was held in Prague on November 9 and 10, 1929. The Chairman of the meeting was Jaksch-Wartenhorst and the Business Manager, Altschul. The meeting was well attended. Among those present were many official representatives from the Government, the University and interested corporations. Professor G. A. Wagner of Berlin was elected an honorary member. The Chairman gave a eulogy of deceased members, particularly of Lajos Hartmann, the Vice-President of the Association, who died shortly before the meeting.

CRANIAL DIAGNOSIS

Schüller (Vienna) reviewed the diseases of the child's skull and demonstrated by roentgenograms, photographs and anatomical preparations the various changes significant for roentgen diagnosis.

Mayer (Vienna) reviewed selected topics in the roentgenology of the ear. For the demonstration of the temporal bone the procedures of Schüller, of Stenvers, and of Mayer have been found most satisfactory. The details of acute and chronic otitis were considered. In these conditions the roentgen picture is of great value; however, indications for operation should not be based on the roentgenogram exclusively.

Herrnheiser (Prague) demonstrated a serial device for simplification of the roentgen technique of the ear.

Löw-Beer (Prague) discussed the roentgen technique proposed by him and recommended serial exposures, the great advantages of which were demonstrated by examples.

Amersbach (Prague) showed pictures of a case of sequestrum of the bone which included the whole labyrinth region and, in addition, the greatly dilated auditory

meatus. He also showed pictures of a case in which the roentgenogram after operation showed behind the operative cavity a sharply demarcated area of rarefaction which indicated an epidural cholesteatoma. The clinical diagnosis of the condition in this case could not have been made by any other method.

Kraus (Prague) showed roentgenograms of a sequestrum of the lateral attic wall before and after operation.

Herzog (Witkowitz) demonstrated roentgenograms of the skull of a case of osteitis fibrosa.

Steiner-Teplitz (Schoenau) showed pictures of a case of tumor of the orbit and discussed the roentgenographically demonstrable changes of the orbit.

Altschul (Prague) showed pictures of the maxillary joint taken by his method which permits clear recognition of the anatomical changes.

Jirka (Saaz) discussed the importance of roentgen diagnosis in dentistry, especially for root tip resection, replantation, antrum treatment, unerupted teeth and localization of foreign bodies.

THORAX

Weil (Prague) demonstrated a sacculated pleuritic exudate of the right lung.

Herzog (Witkowitz) showed roentgenograms of the projectile in the right heart. In the discussion, Altschul and Holfelder reported foreign bodies in the heart observed by them.

ABDOMEN

Gurniak (Prague) reported the roentgen examination of a case of gastroenterostomy in which the lower ileum was mistakenly used by the surgeon for the anastomosis. Report was also made on a polyp in the bulbus duodeni.

Weil (Prague) showed pictures of a case of difficult evacuation through the rectal ampulla and of five tumors of the small intestine.

Beutal and Mahler (Prague) showed pictures of a gastric diverticulum close to the heart. The diagnosis of the condition was confirmed gastroscopically.

Herzog (Witkowitz) demonstrated papillomas at the stomach exit coexistent with niche ulcer in the duodenum.

Gütig (Witkowitz) showed pictures of an echinococcosis of the spleen.

Reimann (Prague) discussed the diagnostic evaluation of the gall-bladder reflex. In doubtful cases this reflex serves as a differential diagnostic test of great value. For this purpose, the so-called Boyden meal is used as the most effective agent for causing contraction of the gall-bladder; or, if the stomach should remain empty, pituitrin is administered intramuscularly. During the time that failure to contract is associated with disease of the gall-bladder, observations on the speed and completeness of gall-bladder emptying can be of only slight clinical importance.

A case was also described in which the whole common bile duct and the hepatic ducts in the liver were spontaneously filled with barium during a gastric study of the duodena papilla.

Reiser (Prague) was able to follow the course of a gallstone to the time of its discharge.

BONES

Jaroschy (Prague) reported 3 cases of joint chondromatosis, 2 of which were in the elbow and one in the knee; and Schütze reported a case of chondromatosis in the shoulder joint which is rarely affected.

Kuh (Prague) showed roentgenograms of a case of Sudeck's bone atrophy in which a Doppler operation completely relieved the bone atrophy, so that subsequent roentgenograms showed normal bone density. In the discussion, Biedl and Hilgenreiner (Prague) spoke on the etiology of this disease. There was also a demonstration of a case of localized ostitis fibrosa of the right tibia.

Weil (Prague) showed pictures of a cystiform tuberculosis of the wrist joint.

Fritsch (Bielitz) reported a case of osteoplastic metastases of the vertebrae in a mammary carcinoma affecting the seventh thoracic and second lumbar vertebrae.

Reiser and Mandler (Prague) reported a case of bone tumor occurring simultaneously in the upper arm and thigh, which may represent multiple metastases of an occult primary tumor or else a Ewing bone sarcoma.

THERAPY OF MALIGNANT TUMORS

Holfelder (Frankfurt) discussed the nature of the carcinoma dose and of the results attained with it. Attempts to increase the lethal effectiveness of the rays have been based on the principle of dividing the dose over a number of treatments as has been done by Pfahler (saturation method), Finzi (in carcinoma of the trachea), Coutard (in tongue and mouth carcinomas) and Holfelder (in gastric carcinomas). A report was given of recent experiments on carcinomas of the esophagus by means of a special cross-fire treatment and divided dosage. In about half of the irradiated cases stenosis was prevented. The speaker is in favor of the establishment of radiotherapeutic clinics modeled after the one at Stockholm. In the discussion, Altschul emphasized the difficulty of the cancer problem because each cancer cell reacts differently toward irradiation. He voiced objection to the roentgen treatment of mouth carcinomas because of the unavoidable injury to the salivary glands. Weibel (Prague) mentioned the difficulty in affecting the very resistant cancerous recidive lymph glands on the pelvic wall and along the vertebrae, and looks forward to much better results from divided dose treatment. Steiner also favors fractional irradiation. Jaksch-Wartenhorst (Prague) strongly endorsed the establishment of radiotherapeutic clinics.

Steiner reported a case of tumor of the right side of the forehead. After roentgen therapy all symptoms disappeared and have not returned after an internal of two years.

ROENTGEN THERAPY OF INFLAMMATORY DISEASES

Fried (Breslau) reported on the roentgen treatment of inflammations of the glandular organs, viz., parotitis, mastitis, orchitis, epididymitis and prostatitis. In about 75 per cent of the cases a satisfactory result was obtained; in the early stages there was a prompt recession, and in the later stages there was acceleration of abscess development and more rapid healing.

Epstein (Aussig) reported the results of roentgen irradiation in inflammations. In 161 cases there were 115 favorably affected. One of the conditions that remained totally unimproved by irradiation was endocarditis of the mild or ulcerating type.

Herzog (Witkowitz) suggested mild irradiations of the spleen for the treatment of multiple furunculosis.

Schiller (Wlaschim) and Altschul (Prague) reported results obtained in patients over seventy years old suffering from prostatitis with urinary retention. By combining roentgen irradiation with the customary conservative therapy, there was obtained in two-thirds of the cases complete relief which has continued now for three years. In the discussion, Gütig expressed preference for the surgical treatment.

Samek (Prague) discussed the roentgen treatment of gonorrhea in the male. There seemed to be no effect in the acute cases, but on the other hand, satisfactory results were obtained in chronic cases with infiltration and complications.

Schoenhof (Prague) reported on the roentgen treatment of erysipelas. In 34 cases, there were only 4 showing no effects, while 21 patients showed an immediate drop in temperature and arrest of the extensive skin symptoms. In

opposition to Fried who recommends the use of heavy filters, Schoenhof favors a 3 mm. Al filtration which also permits the treatment of patients at home by means of smaller portable apparatus.

Jirka (Saaz) recommends roentgen therapy in the modern dental treatment of cases of periostitis.

Bardachzi (Aussig) discussed the roentgen treatment of Basedow's disease. When internal treatment fails to give prompt results, irradiation should be tried. Surgical treatment is to be given in those cases with symptoms of compression or which have been found refractory to the roentgen rays. Skin hypersensitiveness was not found in any of the patients with Basedow's disease. This opinion was opposed by Fried, Altschul and Holfelder because this question, which is unimportant in the treatment by small doses, is not yet settled. Steiner discussed the question of adhesions following roentgen treatment, which do not occur according to recent results with correct technique. Herrnheiser, Guhr and Holfelder discussed the control of irradiation by determination of the basal metabolic rate. The latter always parallels the clinical condition but not always simultaneously; the clinical symptoms may recede very much sooner and vice versa. Guhr suggested the determination of creatinine in place of the basal metabolism and recommended a post-irradiation handling through dietetic and hygienic precautions. Concerning the dosage, all who participated in the discussion emphasized the necessity for individual treatment which must be based on the severity of the disease. The whole discussion showed that the conservative attitude of most surgeons is not justified.

RADIUM THERAPY

Markl (St. Joachimsthal) had carried out experiments to find directly measurable relations between the dose used in emanation therapy and the threshold value of the biologically effective radiant energy. He made the astonishing discovery that the dosage found empirically to be satisfactory is in fact at the threshold value of the biologically effective radiant energy.

MISCELLANEOUS

Gütig (Witkowitz) expressed objection to the practice of basing conclusions concerning the operability of a gastric carcinoma upon the roentgen findings alone. This objection was supported by Schütze.

Altschul (Prague) reported the results of roentgen therapy in certain cases of the less common diseases, such as periarthritis humeroscapularis, spondylarthritis ankylopoetica and hemophilia.

TECHNIQUE

Spiegler (Vienna) demonstrated an acoustic milliammeter-minute counter which permits the acoustic detection of the magnitude of the tube current by means of the variable frequency of a light tapping signal.

Busso (Vienna) described different types of inductive fine controls whereby one can exactly adjust the tube voltage to any value within the usual limits.

MONUMENT OF ROENTGEN

It is proposed by the Rheinisch-Westfälische-Röntgen Society, through its founder and president, Prof. P. Krause in Münster, that a life size monument of Roentgen be erected in his birthplace of Lennep. The city of Lennep has given the most beautiful spot in the town for this purpose, and the cost of the monument is being raised by voluntary subscription.

American roentgenologists are invited to contribute to this fund, and it is hoped that a sum of $2500, which is a quarter of the cost of the monument, can be raised in this country. Upon consultation with the presidents of the American Roentgen Ray Society and the Radiologi-

cal Society of North America, it was decided to send out letters asking for donations. Thirteen hundred and eighty letters were sent to radiologists on March 15, 1930. Over a hundred generous contributions have been received, the total sum collected thus far being $900. It is hoped that the remaining $1600 will be contributed by the 1200 roentgenologists who have not yet responded.

Checks should be sent to Otto Glasser, Ph. D., Cleveland Clinic Foundation, 2050 E. 93rd St., Cleveland, Ohio. The funds which are collected will be transferred to the "Denkmalsfonds der Rhein, Westf. Röntgengesellschaft" of the "Deutsche Bank, Duesseldorf," and the names of the contributors will be sent to Prof. P. Krause, 3 Westring, Münster, i. W. Germany.

THE JOHN PHILLIPS MEMORIAL PRIZE

The American College of Physicians announces the JOHN PHILLIPS MEMORIAL PRIZE of $1500.00, to be awarded for the most meritorious contribution in Internal Medicine and sciences contributing thereto, under the following conditions:

(1) The contribution must be submitted in the form of a thesis or dissertation based upon published or unpublished original work.

(2) It must be mailed to the Executive Secretary of the American College of Physicians on or before August 31, 1930.

(3) The thesis or dissertation must be in the English language, in triplicate, in typewritten or printed form, and the work upon which it is based must have been done in whole or in part in the United States or Canada.

(4) The recipient of the prize would be expected to read the essay at the next Annual Meeting of the College, after which he would be officially presented with the prize by the President.

(5) The College reserves the right to make no award of the prize if a sufficiently meritorious piece of work has not been received.

(6) The announcement of the prize winner will be made not later than two months before the Annual Meeting.

American College of Physicians
E. R. Loveland, Executive Secretary
133–135 S. 36th Street
Philadelphia, Pa.

AMERICAN ROENTGEN RAY SOCIETY

PRELIMINARY PROGRAM

Thirty-first Annual Meeting, West Baden Springs Hotel, West Baden, Indiana, September 23–26, 1930.

The Nasal Accessory Sinuses; Roentgenographic and Clinical Observations. Bundy Allen, M.D., Tampa, Florida.

The Relationship between the Roentgenologist and the Surgeon in the Treatment of Diseases of the Stomach and Duodenum. D. C. Balfour, M.D., Rochester, Minnesota. (By invitation.)

The Clinical Study of "Colitis" with Special Reference to so-called "Colitis." J. A. Bargen, M. D., Rochester, Minnesota. (By invitation.)

Opaque Oils in Maxillary Sinus Disease. Raymond C. Beeler, M.D., L. A. Smith, M.D., and J. N. Collins, M.D., (by invitation), Indianapolis, Indiana.

The X-ray Diagnosis and the Roentgen Therapeutic Results in Lymphosarcoma of the Mediastinum and Lungs. W. W. Belden, M.D., and John Remer, M.D., New York City.

Fixation and Posture of Infants for Roentgen Ray Examination. David R. Bowen, M.D., Philadelphia, Pennsylvania.

The Roentgenologist in Industrial Surgery. E. C. Samuel, M.D., and E. R. Bowie, M.D., New Orleans, Louisiana.

Intravenous Urography. W. F. Braasch, M.D., Rochester, Minnesota. (By invitation.)

Rickets. Ralph S. Bromer, M.D., Philadelphia, Pennsylvania.

The Value of the Roentgenological Examination in Pulmonary Tuberculosis. Lawrason Brown, M.D., Saranac Lake, New York, and Homer L. Sampson, M.D., Trudeau, New York. (By invitation.)

Displacements of the Gastrointestinal Tract by Extrabowel Pathology. P. F. Butler, M.D., Boston, Massachusetts.

Coccidioidal Granuloma: Roentgen Diagnosis. Ray Carter. M.D., Los Angeles, California. (By invitation.)

Technic and Differential Roentgen Diagnosis of Carcinoma of the Pelvic Colon. James T. Case, M.D., Chicago, Illinois.

Subject to be announed later. William Gregory Cole, M.D., New York City. (By invitation.)

Caldwell Lecture: The History of the Development of the Hot-Cathode Tube. William D. Coolidge, Ph.D., Schenectady, New York.

Subject to be announced later. A. W. Crane. M.D., Kalamazoo, Michigan.

Fractures of the Anterior Superior Border of the Os Calcis due to Indirect Violence. H. W. Dachtler, M.D., Toledo, Ohio.

Epiphyseal Tuberculosis of the Spine. Howard P. Doub, M.D., and Carl Badgley, M.D., Detroit. Michigan. (By invitation).

Is Irritation a Cause of Cancer? Arthur W. Erskine, M.D., Cedar Rapids, Iowa.

A Review of 42 Cases of Melanosarcoma. William A. Evans, M.D., Detroit, Michigan.

Wilhlem Conrad Roentgen and the Discovery of the Roentgen Rays. Otto Glasser, M.D., Cleveland, Ohio. (By invitation.)

The Roentgen Management of Chronic Leukemia. Ross Golden, M.D., K. R. McAlpin, M.D. (by invitation), and Katharine S. Edsall, B.S., New York City. (By invitation).

Further Observations on the Treatment of Superficial Malignancy. George W. Grier, M.D., Pittsburgh, Pennsylvania.

The Postpneumonic Lung. A. L. Hart, M.D., Tacoma, Washington. (By invitation.)

Congenital Idiopathic Hypertrophy of the Heart with the Roentgen Findings in Two Cases. George W. Holmes, M.D., Boston, Massachusetts.

Blood Changes in the Lymphomata and the Leukemias and their Bearing on Roentgen Ray Therapy. Raphael Isaacs. M.D., Ann Arbor, Michigan. (By invitation.)

Lesions of the Diaphragm. E. L. Jenkinson, M.D., Chicago, Illinois.

Necessity for Accurate Technic in Oral Cholecystography and Errors Attributable to Technical Failures. B. R. Kirklin. M.D., Rochester, Minnesota.

Tuberculous Atelectatic Cirrhosis of the Lung. Karl Kornblum. M.D., and Richard T. Ellison, M.D., Philadelphia, Pennsylvania. (By invitation)

X-Ray Dosage. E. T. Leddy, M.D., Rochester, Minnesota.

Giant Cell Bone Tumor: Roentgen and Differential Diagnosis. Leon T. Lewald, M.D., New York City.

Diagnosis of Foreign Bodies in the Air Passages. W. F. Manges, M.D., Philadelphia, Pennsylvania.

Uterine Hemorrhage Without Demonstrable Pathology. Charles L. Martin, M.D., Dallas, Texas.

Pneumoconiosis (Silicosis). (a) The Pathological Characteristics. (b) The Roentgenological Aspects. H. K. Pancoast, M.D., and E. P. Pendergrass, M.D., Philadelphia, Pennsylvania.

Radiation in the Treatment of Bone Tumors. G. E. Pfahler, M.D., and Leo D. Parry, M.D. Philadelphia, Pennsylvania. (By invitation).

The Roentgen-Ray Toleration Dose for the Myocardium of Rats. E. A. Pohle, M.D., Madison, Wisconsin, and A. S. Warthin, M.D. Ann Arbor, Michigan. (By invitation).

Roentgen Observations on the Movement of Pleural Effusions. Leo G. Rigler, M.D., Minneapolis, Minnesota.

Early Roentgen History. E. H. Skinner, M.D., Kansas City, Missouri.

A Discussion of the Occurrence of Benign Ulcer on The Greater Curvature. John Sproull, M.D., Haverhill, Massachusetts.

Oral Cholecystography. William H. Stewart, M.D., New York City.

Automatic Polarizer for Synchronous Rectifier. Robert B. Taft, M.D., Charleston, South Carolina.

Intravenous Cholecystography. Charles A. Waters, M.D., Baltimore, Maryland.

Skin Tolerance with Variable Intensities and Qualities of Roentgen and Radium Irradiation of Cancer. B. P. Widmann, M.D., Philadelphia, Pennsylvania.

Subject to be announced later. E. A. Merrit, M.D., Washington, D. C.

BOOK REVIEWS

Books Received Are Acknowledged under Heading: Books Received. This must be regarded as a sufficient return for the courtesy of the sender. Selections will be made for review in the interests of our readers and as space permits.

X-Ray Technology. The Production, Measurement and Applications of X-Rays. By H. M. Terrill, Ph. D., Associate in Physics, Institute of Cancer Research, and C. T. Ulrey, Ph.D., Research Physicist, Westinghouse Lamp Company. Cloth. Price, $4.50. Pp. 256, with 143 illustrations. New York: D. Van Nostrand Co., 1930.

This work will at last provide a collected source of information regarding x-ray and high voltage technique needed by every new convert to the field of x-ray application or research. Moreover, the radiologist, who has a curiosity about the forces he is harnessing and the tool he is using, will find in this book an answer to many of his questions. As an engineer is better able to fully appreciate a steam pump after he has built one, so a radiologist will better appreciate the tools he is using if he knows about details and difficulties of their manufacture. The authors, representing the university and commercial type of research training, are in an excellent position to provide just enough of such information.

The opening chapter gives a clear qualitative non-mathematical discussion of the properties of electrons, the practical bearing of which is felt throughout the book. Then follow ten chapters covering the x-ray tube, its manufacture and operation, with many practical "wrinkles" of particular value to the laboratory worker; and two more covering briefly the very broad field of high voltage equipment and measurement. The remaining chapters deal with the x-ray output, its measurement and applications in biology, roentgenography and analysis of materials—of necessity treated very briefly. All chapters contain many technical details which do much to provide one with a conception of the problems with which he is dealing.

"X-Ray Technology" is what its name implies and yet the authors have omitted practically all references of a technological nature. In the pages available it is impossible to cover the field in full detail but complete references would do much to enable the reader to build more easily upon the author's well-constructed foundation.

Lauriston S. Taylor

Roentgenographic Technique. A Manual for Physicians, Students, and Technicians. By Darmon Artelle Rhinehart, A.M., M.D., Professor of Roentgenology and Applied Anatomy, School of Medicine, University of Arkansas; Roentgenologist to St. Vincent's Infirmary, Baptist State Hospital, Missouri Pacific Hospital, and the Arkansas Children's Hospital. Cloth. Price $5.50. Pp. 388, with 159 illustrations. Philadelphia: Lea and Febiger, 1930.

As every roentgenologist realizes the importance of having good roentgenograms for interpretation, there need be no apology for a new work on roentgen technique which helps procure them. Dr. Rhinehart has produced a volume which embodies the fundamentals of modern practice as well as outlining a system which, if followed, should give excellent results. While not in accord with all of his ideas, we feel that he displays an unusual understanding of the problems involved and explains them in a manner that should be clear even to the novice.

The text is not of the catechismal or "question and answer" variety. The matter is presented with a singular uniformity of style and arrangement that necessitates careful reading, but we believe this to be an advantage rather than a detriment.

The author presents a very readable exposition of the fundamentals of x-ray physics, dark room procedure and of the types of equipment in general use; features which are necessary for the information of the student or embryo technician. The several tables, graphs and diagrams add to the usefulness of the text and are equally applicable to any form of apparatus. Positions for making all the usual examinations are illustrated and explained. No pretense is made of covering all possible cases, many, of necessity, being left to the ingenuity of the roentgenologist.

Whether or not the roentgenologist has time to read the book in detail he should, in the interests of better work, require each of his technical assistants to read it.

E. W. Hall

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ABSTRACTS OF ROENTGEN AND RADIUM LITERATURE

ROENTGEN DIAGNOSIS

HEAD

SCHÜLLER, ARTHUR. Craniostenosis. *Radiology*, Nov., 1929, 13, 377–382.

The author applies the term craniostenosis only to those anomalies which lead to a diminution in the actual size of the skull cavity. Such a contraction is caused most commonly by premature closure of the sutures of the skull.

The clinical symptoms of craniostenosis are dependent upon two factors: (1) the deformity, and (2) the contraction of the skull. As a result of the deformity of the basal bones the cranial nerves are often pulled, kinked, and compressed, so that serious disturbances of vision, hearing and smell may take place. The roentgen appearances enable the examiner to determine with considerable exactness the degree of contraction and deformity of the skull, including the basal bones. The degree of contraction is estimated by the extent of the impressiones digitatae and the juga cerebralia, and the amount of deformity is judged by the degree of depression of the floor of the middle cerebral fossa.

The condition of the fluid spaces in the craniostenotic skull is markedly variable and of considerable practical significance. The distribution of these spaces can be determined by the roentgen examination, especially by means of contrast filling with air or lipiodol. Most commonly there is a constriction of the intracerebral fluid spaces. On the other hand, the extracerebral spaces, especially the basal cisterna and the subarachnoid spaces, appear to be filled to a normal extent. In rare cases there may be an abnormal widening of the fluid spaces—a combination of craniostenosis with hydrocephalus. The presence of this combination may be determined roentgenologically without any contrast filling, from the widening of the sella turcica. With uncomplicated craniostenosis the sella turcica appears to be entirely normal.

The roentgen examination also permits a differential diagnosis between craniostenotic skull deformities and other types of form anomalies of the skull such as microcephaly vera, pseudomicrocephaly, hydrocephalus and either generalized or local hyperostosis of the skull. In the most extensive cases of craniostenosis other skeletal anomalies are found, particularly in the distal portions of the extremities. Trigonocephaly, hypertelerismus and chondrodystrophia are other skull deformities due to premature synostosis.

In addition to the primary obliterations of the sutures which are to be regarded as congenital anomalies there is also a secondary type of synostosis which is acquired and may occur after traumatic injury to the suture lines, in the course of certain diseases of the skull such as rickets, or in early acquired brain disturbances.

The roentgen examination of the skull is of extreme importance in determining the diagnosis and prognosis of those types of skull deformity grouped under the name of craniostenosis, in the narrower sense. The various disturbances that accompany these skull anomalies may be favorably influenced by roentgen therapy or by operative decompression—*J. D. Camp.*

CAMP, JOHN D. The roentgenologic manifestations of intracranial disease. *Radiology*, Dec., 1929, *13*, 484–493.

In order of their importance the various roentgen signs of intracranial disease are grouped as follows: (1) calcification within the lesion itself; (2) localized changes in the bone, such as destruction, proliferation or both; (3) changes in the sella turcica; (4) changes in the bone from increased intracranial pressure; (5) displacement of the pineal shadow; (6) air in or about the lesion, and (7) increased vascularity of bone. Lesions that may exhibit calcification include tumors, hematomas, tubercles, cysts, old abscesses, old meningeal lesions, encephalitis, sclerotic arteries and aneurysm. Such calcification requires distinction from the calcification which often occurs normally in the pineal gland, choroid plexus and pacchionian bodies. The bones of the skull overlying a contiguous tumor may exhibit locally the changes of destruction, proliferation or both. Most often the change consists of thinning of the internal table. Hyperostosis may occur, especially in association with parasa-

gittal tumors and those that arise from the temporofrontal meninges. Lesions causing deformity of the sella turcica include benign and malignant tumors of the pituitary gland, extrasellar tumors giving rise to increased intracranial pressure, and disease of the sphenoid bone. Displacement of the shadow of the pineal gland is valuable in the diagnosis and localization of intracranial tumors. Increased vascularity of the bone is likely to accompany angiomatous tumors of the cortex.

The value of the foregoing signs has been variously appraised. Crouse, from a review of the literature, estimated that 8 per cent of the lesions of the brain can be diagnosed from the roentgenogram. Dandy computed that 15 to 20 per cent can be localized. Sosman, reviewing the main groups of tumors, was able to identify the tumor by means of the roentgen ray alone in 37 per cent.—*J. D. Camp.*

Guttmann, Ludwig. Möglichkeiten und Grenzen der Enzephalographie bei zerebraler Kinderlähmung. (Possibilities and limitations of encephalography in cerebral infantile paralysis.) *Fortschr. a. d. Geb. d. Röntgenstrahlen*, Dec., 1929, *40*, 965–978.

Seven cases of infantile paralysis with unilateral localization to the brain are described more or less in detail and illustrated with encephalograms and in some instances with post-mortem sections.

It was found that the basis of a unilateral cerebral infantile paralysis as demonstrated from the roentgenograms is (1) an atrophy of one-half of the brain with or without cyst formations; (2) sequelae of meningitis or meningo-encephalitis, and (3) primary developmental anomalies.

In connection with this, attention is called to the fact that encephalography does not always lead to the demonstration of cyst formations. This is especially true (1) in the cases with a subcortical localization of the cyst in which the cyst has failed to erode the ventricular wall and thus establish a connection with the subarachnoid fluid spaces, and (2) in the cases of external cysts in which although there is a communication with the subarachnoid spaces because of the extensive adhesions between the meninges and the wall of the cyst a replacement of the cerebrospinal fluid with air is impossible.

It is also mentioned that several of the cases have shown a rather remarkable improvement following encephalography. Although this improvement was of only temporary duration it is advocated that encephalography be used therapeutically in all cases with very severe symptomatology.—*T. Leucutia.*

Löw-Beer, A. Über die Ausführung der Stenversschen Aufnahme bei reiner Seitenlage des Schädels. (On the application of the Stenvers method in true lateral position of the skull.) *Fortschr. a. d. Geb. d. Röntgenstrahlen*, Dec., 1929, *40*, 979–983.

As is known the Stenvers method (for the roentgenography of the mastoid process) necessitates a rather complicated technical procedure. In attempting to standardize the various methods used for the roentgenographic demonstration of the auditory organs the author modified the Stenvers method so as to be able to make use of a true lateral position of the skull.

The procedure is as follows: the patient is placed on the side with the sagittal plane of the cranium parallel to the film cassette. The tube is arranged with its axis parallel to the auriculo-infra-orbital plane of the skull and is angulated 30 to 35° (according to the configuration of the skull) posteriorly and 10 to 12° cranially. The central ray passes through a point which lies four fingers behind and four fingers above the external auditory meatus of the opposite ear and emerges from the skull exactly 2 cm. in front of the external auditory meatus of the ear to be examined.

The advantages of the method are (1) that it gives an excellent view of the cellular structure of the entire mastoid process; (2) that it permits a better observation of the pneumatic cell system, especially with regard to the site, form and extent of the cellular destruction; (3) that the tegmen tympany is well visualized permitting the detection of erosions or fissures, and (4) that the petrous portion of the bone and in a few instances the labyrinths are also made visible.

In case of demonstration of the petrous portion of the bone it is recommended that the angulation of the tube in the cranio-caudal direction be made 10 to 12° caudally instead of cranially and that the point of entry of the central ray be chosen four fingers behind the external auditory meatus of the opposite ear

and the point of emergence 2 cm. in front and 1 cm. above the external auditory meatus of the ear to be examined.—*T. Leucutia.*

HERRNHEISER, GUSTAV. Vereinfachung der röntgenologischen Aufnahmetechnik des Gehörorgans. (Simplification of the roentgen technique for the auditory organs.) *Fortschr. a. d. Geb. d. Röntgenstrahlen*, Dec., 1929, *40*, 984–999.

The author describes in detail a new apparatus which he constructed for the roentgen examination of the auditory organs in the four standard positions of Schüller, Sonnenkalb, Mayer, and Stenvers (modification of Löw-Beer).

The essential parts of the apparatus are: (1) a cassette which is similar to Berg's cassette for serial roentgenography of the duodenum and which permits the taking of the four standard roentgenograms in series; (2) an indicator for establishing an accessory point of centering outside of the projection of the skull, thus eliminating the tedious work of trying to locate a point on the part of the cassette which is covered by the patient's head. The indicator consists of a celluloid rule provided with a small cone at one end (for the fixation of the ruler in the external auditory canal of the ear to be examined) and a landmark on the other end (for the point of centering of the parallelogram); (3) a special centering device consisting of a metallic parallelogram which is mounted on the cylindrical diaphragm of the tube.

The top of the cassette on which the patient's head lies is marked with lines at definite distances so that one may center to any particular point. Since the movements of the parallelogram follow exactly those of the cylindrical tube, an angulation of the parallelogram (for different degrees) leads to a precisely identical angulation of the tube.

The following are the angulations for the four standard methods: (*a*) Schüller: 30° cranially (the central ray emerging from the skull at the external meatus of the ear to be examined); (*b*) Sonnenkalb: 15° cranially and 15° towards the occiput (the central ray emerging 1 to 2 cm. behind the external meatus of the ear to be examined); (*c*) Mayer: 40° cranially and 40 to 45° towards the face (the central ray emerging at the external meatus of the ear to be examined); (*d*) Stenvers (Löw-Beer modification): 10° caudally and 33° occipitally (the central ray emerging 2 to 3 cm. in front and 1 cm. above the external meatus of the ear to be examined). The head is always placed in a true lateral position so that the sagittal plane of the cranium is parallel to the horizontal plane of the cassette.—*T. Leucutia.*

COTTENOT, PAUL, and FIDON, MAURICE. Technique d'examen radiologique du rocher et del la mastoide sous trois incidences; interprétation des images normales. (Technique of roentgen examination of the petrous portion and of the mastoid by three incidences; interpretation of normal images.) *J. de radiol. et d'électrol.*, Jan., 1930, *14*, 1–12.

In order to simplify as much as possible the rather complicated procedures for the roentgen examination of the petrous portion of the temporal bone and of the mastoid, the authors make use of three positions, the incidence of the central ray being as follows: (*a*) an incidence perpendicular to the long axis of the petrous portion of the temporal bone (similar to the oblique sagittal incidence of Lannois and Arcelin and of Stenvers); (*b*) an incidence practically parallel with the long axis of the petrous portion of the temporal bone (similar to the oblique profile incidence of Hirtz, the incidence of Surrel, Schüller and Law, the postero-lateral oblique incidence of Lange, the transverse and oblique incidence of Gaillard), and (*c*) an incidence which is 45° oblique to the long axis of the petrous portion of the temporal bone such as described by Mayer.

Instead of expressing the incidence of the central rays in terms of their obliquity to the axis of the petrous portion of the temporal bone, the authors prefer to use the denominations of the point of entry and emergence of the central ray through the skull. According to this the three positions are called: (1) incidence occipito-zygomatic; (2) incidence temporo-tympanic, and (3) incidence fronto-tympanic.

The authors describe in detail the special apparatus which they have constructed for the roentgenography of the petrous portion of the temporal bone and of the mastoid in the three above positions. The main advantage of this apparatus is that apart from a good immobilization of the skull it permits (by means of a cen-

tering device) the exact positioning of the tube for the various incidences.

(1) Occipito-zygomatic incidence. The point of entry corresponds to the opposite external occipital protuberance while the point of emergence is situated half between the external auditory meatus and the external angle of the orbit on the side to be examined.

The patient is placed in ventral decubitus with the face horizontally on the film holder, the head being flexed and inclined so that the median sagittal plane of the skull forms an angle of 45° with the film holder.

(2) Temporo-tympanic incidence. The point of entry is situated in the opposite temporal region 7 cm. above the external auditory meatus while the point of emergence corresponds to the external auditory meatus on the side to be examined. It is necessary in this position to fold the ear so that the mastoid image projects clearly on the film.

The patient is placed on his back, the opposite shoulder being elevated by a pillow. The head is exactly in profile, flexed, and the median sagittal plane of the cranium is strictly parallel with the film.

(3) Fronto-tympanic incidence. The point of entry is situated in the opposite frontal region, 7 cm. above the orbital arch, on a line which runs parallel with the ridge of the nose and it passes through the external angle of the orbit, while the point of emergence corresponds to the external auditory meatus of the side to be examined.

The patient is placed in dorsal decubitus, the film holder being inclined and the head of the patient being placed in a semi-lateral position so that the median sagittal plane of the cranium forms an angle of 45° with the horizontal plane. The head is flexed to its maximum in order that the external auditory meatus may be as close as possible to the film holder.

All three positions are clearly illustrated by numerous photographs.

In a second part of the paper the interpretation of the images obtained in the above three positions is discussed. The first position is of great advantage in demonstrating the mastoid cells in their entirety and their relation to the antrum. It is essential in this position that when the petrous portion of the temporal bone is studied a greater time of exposure be given than when studying only the structural arrangement of the mastoid cells.

The second position gives a very complete view of the surgical mastoid, demonstrates the relation between the antrum and the lateral sinus, the appearance of the cells in the vicinity of the lateral sinus and especially the extension of the inflammatory process to the meninges. It also gives a very good view of the temporomandibular articulation.

The third position is of value in the study of the cavities of the middle ear, antrum and periantral cells. It also demonstrates the relation between the antrum and the lateral sinus; it permits the study of the external auditory canal (important in atresia and malformations) and especially of the petrous portion of the temporal bone.—*T. Leucutia.*

Sedgindise, G. Die Frühdiagnostik der Pyorrhoea alveolaris mittels Röntgenstrahlen. (Early diagnosis of pyorrhea alveolaris by roentgen rays.) *Fortschr. a. d. Geb. d. Röntgenstrahlen*, Dec., 1929, *40*, 1054–1060.

Of 2000 cases of pyorrhea alveolaris, in 685, that is 29.2 per cent, the roentgen diagnosis could be made before there was evidence of any clinical manifestation of the disease. Forty-three of these cases were periodically observed for one year and ten months and the successive stages of development of the pyorrhea recorded.

It was found that in the beginning there is evidence of an atrophy and inflammation of the alveolar process alone. Only later does the inflammation extend to the periodontium and to the gums, producing the well-known clinical picture of the disease. It was also found that pyorrhea alveolaris as a rule starts with the lower central incisors from which it extends to the upper central incisors and then to the other teeth.

It is evident that an early diagnosis of pyorrhea alveolaris is very important both from the standpoint of prognosis and therapy. Therefore it is advised that in all cases suspicious of pyorrhea a roentgen examination of the teeth be made early and not wait until the disease has fully developed clinically.

The author is of the opinion that the bone atrophy which was found to be the primary manifestation of the disease does not represent a nosologic entity but that it is merely a symptom incidental either to trauma or to some

inflammatory process. Further experiments are in course in order to elucidate this problem.

It is suggested that in addition to the four stages of pyorrhea alveolaris described by Faulhaber and Neumann, a fifth stage, that of pyorrhea alveolaris incipiens be distinguished. This stage can be diagnosed roentgenologically months or years before there is any clinical manifestation of the disease.—*T. Leucutia.*

NECK AND CHEST

TRUFFERT and NEMOURS. Spasme pharyngo-oesophagien par développement anormal du sillon glosso épiglottique (faux aspect diverticulaire). (Pharyngo-esophageal spasm due to abnormal development of the glosso-epiglottic groove—pseudo-diverticular aspect.) *Bull. et mém. Soc. de radiol. méd. de France*, Nov., 1929, *17*, 259–260.

A peculiar condition consisting in a pseudo-diverticulum of the glosso-epiglottic groove was observed in a young man who for a period of three years complained of spells of pharyngo-esophageal spasm. The malformation, which has remained recalcitrant to all forms of therapy, is very rare.—*T. Leucutia.*

KAPLUNOWA, D. Der Einfluss physischer Arbeit auf die Herzgrösse. (The influence of physical work on the size of the heart.) *Fortschr. a. d. Geb. d. Röntgenstrahlen*, Nov., 1929, *40*, 816–821.

The author examined the influence of hard labor on the size of the heart in 110 blacksmiths of a Moscow steel plant. Orthodiagraphy was used as the method of examination, a first tracing having been made in the morning before the beginning of the day's work and a second tracing during the noon recess following four and a half to five hours of heavy labor.

According to the size of the heart previous to the examination the cases were divided into three series: (1) those with normal size of the heart—46 cases (41.8 per cent); (2) those with enlargement of the heart but without any pathological changes—27 cases (24.6 per cent), and (3) those with pathologically enlarged hearts—37 cases (33.6 per cent).

Of the 46 cases of series 1, in 6 cases (13 per cent) a slight enlargement, in 9 cases (20 per cent) no enlargement and in 31 cases (67 per cent) a diminution of the heart developed following actual labor.

Of the 27 cases of series 2, in 3 cases (11 per cent) a slight enlargement, in 7 cases (26 per cent) no enlargement and in 17 cases (63 per cent) a diminution of the heart developed following actual labor.

Of the 37 cases of series 3, 31 cases (83.8 per cent) developed an enlargement of the heart following actual labor, in 18 cases the enlargement being from 0.5 to 1 cm. while in the rest from 0.2 to 0.3 cm.

Ten cases, nearly all with enlargements of the heart but without pathological changes, were then subjected to extra hard labor and examined four and a half to five hours later. These cases behaved in a manner identical to those of series 2.

The conclusion is reached that hard labor leads to a diminishing in size of the normal and of the slightly enlarged but well-compensated hearts, while in the pathological hearts (except the well-compensated cases) an enlargement of the heart results. It seems that this behavior of the cardiac muscles could be used as a test of the functional adaptability of the heart.—*T. Leucutia.*

RÖSLER, H. Rechtsseitige, mitgeteilte Hilus-pulsation bei aneurysmatischer Erweiterung des linken Vorhofes. (Right-sided transmitted hilar pulsation in aneurysmal enlargement of the left auricle.) *Fortschr. a. d. Geb. d. Röntgenstrahlen*, Dec., 1929, *40*, 1017–1019.

Thirty cases of mitral and combined heart lesions with an aneurysm-like dilatation of the left auricle were observed, in 6 of which the dilatation was so pronounced that the right border of the heart was occupied entirely by the enlarged left auricle. In all cases there was a pulsation of the right border of the heart which was transmitted to the hilus.

It is the author's contention that the pulsation observed in the aneurysm-like dilatation of the left auricle is due to the lessened resistance of the auricular wall and to the close vicinity of the right branch of the arteria pulmonalis which transmits the pulsation to the hilus.—*T. Leucutia.*

VALLEBONA, A. Attivita cardiaca e pneumotorace. (Heart action and pneumothorax.) *Radio. med.*, Dec., 1929, *16*, 1173–1188.

The author has made a systematic study of the effect exercised on the heart muscle by

pneumothorax, particularly the direct influence on the heart of the gas in the pleural cavity. He made roentgenoscopic examinations of the movements of the heart, by means of which he was able to study the appearance of its contractions, and registered the movements roentgenographically by means of a special method which he has devised. The contraction of the heart has a peculiar appearance on the side of the pneumothorax; it is more rapid than normal and has an oscillating appearance like that of a spring set free. He thinks this is not due so much to the conditions of intrapleural pressure as to the fact that the heart is moving in a gaseous medium and its movements are not restrained by the elastic pressure of the air contained in the alveoli of the lungs. This restraining action of the lung tissue is lacking not only in pneumothorax but also in pneumopericardium, in which something of this same form of pulsation is seen. He concludes that this special spring-like movement of the pulsation is of value in the diagnosis of pneumothorax, as it occurs when there is even a small amount of gas in the pleural cavity, too little to be demonstrated roentgenologically.—*A. G. Morgan.*

Wasson, W. W. Bronchosinusitis disease. *J. Am. M. Ass.*, Dec. 28, 1929, *93*, 2018–2021.

In cases of infection the respiratory tract should be considered in its entirety. A common mistake is to consider as localized an infectious process which is really a part of a general respiratory tract condition which is more marked at one point due to some anatomical defect, trauma, etc. The lungs are the only portion of the respiratory tract which can be affected by means not common to the other parts of the system; i.e., by means of the blood stream which drains from all other parts of the body through the lungs. Except for the possibility of the lungs alone thus being affected, infection is general throughout the respiratory system and should be known as "bronchosinusitis disease." Chronic infections progress insidiously, and may have their origin in early infancy. The roentgenogram of the lung of children so affected becomes typical. Fibrosis extends from the hilus outward. This appearance plus the roentgenogram of sinus disease is pathognomonic of bronchosinusitis disease.

Ninety children have been followed from birth to the age of 8. In this study it was noted that newborn infants with mucus in the pharynx and trachea do not entirely get rid of this mucus. Later they develop symptoms of thymic stridor. This stridor is due to infections of the sinuses, bronchi and most of the respiratory tract. Some of these children get well spontaneously when they develop respiratory reflexes (9 to 12 months). Others continue as victims of repeated respiratory infections and develop sinusitis, bronchitis, or asthma at from 1½ to 3 years of age. The roentgenogram is not typical. Much adult disease of this type is a result of chronicity from infancy.—*G. R. Miller.*

Bigler, John A. Interpretation of roentgenograms of the chest in children based on observations at necropsy. III. Diseases of the lungs, of the pleura and of the mediastinum. *Am. J. Dis. Child.*, Jan., 1933, *39*, 91–106.

The author presents the studies of 171 children in which he attempts to correlate the pathological and roentgenological findings. The incidence and mortality of bronchopneumonia is higher than that of lobar pneumonia. Bronchopneumonia may be pseudolobar with the shadows restricted to one lobe, but most frequently it has a wider distribution and is represented by areas of increased density in the parenchyma. Lobar pneumonia occurred less frequently than bronchopneumonia.

The collapse of the lung is usually associated with a foreign body or plug of mucus, and attention is called to the fact that the involvement may be of a whole lung, one lobe, or a part of one lobe. He presents some phenomena attempting to explain the displacement of the mediastinal structures.

The author states that he has had very little experience with asthma and emphysema but he noted some flattening of the domes of the diaphragm, the transparency of the lung was increased, and the linear markings extended to the periphery.

The disease of the pleura was divided into two groups: (1) disease of the pleura without fluid, and (2) disease of the pleura with fluid. A thickened pleura may be represented by a dense shadow along the lateral chest wall or by various sized areas of increased density involving portions of the pulmonary fields through which

lung markings can be seen. Pleural adhesions were common but were not often seen on the roentgenogram. In simple empyema there is never a change of fluid level.

In an early pleural collection the shadow is usually at the base, homogeneous, and tends to extend along the lateral chest wall, and pushes the lung medially so that a definite line can be seen demarcating a pulmonary border. In large effusions the heart, mediastinum and trachea are always pushed to the opposite side and there is a widening of the intercostal spaces. Pneumothorax and pyopneumothorax are not rare in children, and their presence does not mean a fatal termination. Post-mortem examination of several patients revealed marked subpleural bullae and blebs, but it was impossible to demonstrate these on the roentgenograms even after a most diligent examination.

The width of the mediastinal shadow was analyzed, and the author states that the shadow of the thymus has a convex or straight border in contrast with a broad mediastinal shadow with concave borders due to the great vessels of the neck. Metastatic malignant involvement of the mediastinal nodes is not rare and casts a characteristic type of bulging shadow with a smooth border.—*E. P. Pendergrass.*

SAYÉ, L. Les images radiographiques du thorax chez les enfants vaccinés par le BCG. (Roentgen images of the thorax in infants vaccinated with BCG.) *Presse méd.*, Nov. 13, 1929, *37*, 1477–1478.

Between November, 1924, and April, 1928, 346 children were vaccinated with BCG (10 per cent of which were vaccinated at the obstetrical clinic and the rest at home). In 129 of the vaccinated cases systematic roentgen examinations of the chest were made at different intervals following the vaccination and the findings were compared with those of 124 non-vaccinated children.

Sixty-one of the vaccinated children were from surroundings where the possibility of contagion was only slight, 36 from surroundings with a possibility of massive contagion and 32 from surroundings without possibility of actual contact. Forty-two per cent of all cases reacted positively to tuberculin.

Of the non-vaccinated or control cases, 41 were from surroundings with slight possibility of infection, 58 from surroundings with possibility of massive contagion and 25 from surroundings without possibility of actual contact.

It was found that all children vaccinated and exposed to massive contagion showed a tuberculous lesion localized chiefly to the mediastinum and roots of the lungs which was of considerably shorter duration and of a more benign type than the similar lesions observed in non-vaccinated children. In an environment with only a slight possibility of infection the vaccinated children appeared immune to virulent infection, and only occasionally was there evidence of extremely discrete and very benign lesions, while in the non-vaccinated children the changes were often rather pronounced. In the children without actual contact with infected persons the vaccination resulted in an entire lack of pathological lesions, while in the non-vaccinated cases not infrequently rather severe changes were found.

It was also observed that the mediastinal lesion in non-vaccinated children often extended into the parenchyma and the interstitium while in the vaccinated children even if there was danger of a massive contagion a periganglionic invasion appeared rarely and was of a very mild degree. The conclusion is reached that the vaccination with BCG is very efficacious since it reproduces the tuberculous process in an attenuated form and since it impregnates the organism with tubercle bacilli early, thus increasing the immunity. For this reason it is advised that the vaccination be done as early as possible.—*T. Leucutia.*

HELMREICH, WERNER. Der Einfluss einiger Faktoren der Aufnahmetechnik auf die Darstellbarkeit von Lungenherden und Kavernen. (The influence of certain factors of exposure technique on the visualization of the lung foci and cavities.) *Fortschr. a. d. Geb. d. Röntgenstrahlen*, Oct., 1929, *40*, 575–602.

The factors pertaining to the technique of exposure for the roentgen visualization of small foci and cavities of the lungs were studied by means of densographic measurements.

In a first series of experiments the effect of the intensifying screen on the quality of the roentgenologic image was analyzed. Since the use of intensifying screens considerably shortens the time of exposure a great amount of current is saved and the life of the tube is

prolonged. At the same time, because of the greater contrast, better roentgen images are obtained. This is especially important in the demonstration of small lesions of the lungs which otherwise may escape detection.

For the comparison of the roentgen images taken with and without intensifying screens, it is necessary that all factors pertaining to the technique of exposure should be the same. Since, however, the use of intensifying screens results in a considerable shortening of the time of exposure the author conceived the idea of interposing copper filters of various thicknesses between the screen and patient so as to make the time of exposure equal to that without the use of intensifying screen. The degree of blackening of the films was analyzed by the densographic method so as to elicit even the smallest changes. The densographic curves were then compared with each other and with those obtained on the film exposed without the use of the intensifying screen. It was found that the curve of the image taken with 0.32 mm. copper cuts the curve of the image without screen at exactly 1.0 which indicates that the copper equivalent is 0.32 mm.

The dependence of the intensifying factor of the screen on the intensity of the roentgen rays (milliamperage) was determined by the procedure of Glocker. This was necessary since the exposures with intensifying screens require the use of a higher milliamperage than the exposures without intensifying screens, a fact which of course cannot be without influence on the blackening of the film.

By taking into consideration the two above factors it was found that a blackening coefficient which is greater than 1.5 leads to entire disappearance of small lesions on the roentgenogram. The optimum coefficient for the exposures made with the use of intensifying screens is 1.2, while in the films without intensifying screen the blackening coefficient may be as high as 2.0 without there being loss of contrast. Within the range of 1.3, however, the exposures taken with the use of intensifying screens lead, on account of the steeper contrast curve, to a better definition of the roentgen image, than the exposures without intensifying screens. This means that (within the range mentioned) roentgenograms with intensifying screens are superior to the ones without intensifying screens. Of course if the blackening coefficient exceeds a value of 1.5, that is, if the film is overexposed, roentgenograms with intensifying screens will fail to show small lesions of the lungs while roentgenograms without intensifying screens still may do so up to a coefficient of 2.0.

In another series of experiments it was determined whether the quality of the roentgen rays undergoes any modification as a result of the absorption of certain rays by various body structures. It is known from deep therapy measurements that the interposition of various media, because of the absorption of the softer rays, leads to an increase in the average hardness of the rays. The author found that the same process takes place within the tissues of the chest during roentgenography. Structures containing calcium absorb a larger quantity of roentgen rays than soft structures. This leads to a varying increase in the average hardness of the rays depending on the absorption coefficient of the various thoracic tissues. The quality of the rays was determined by the half-value layer by analyzing small bundles of roentgen rays passing through different parts of the chest. The roentgenograms obtained were read by the densographic method. In more advanced lesions it was found that the roentgenograms without intensifying screens showed no noticeable difference of the blackening coefficient for various parts of the chest, while in the roentgenograms with intensifying screens the difference was very marked, more so in the regions with large calcium deposits. This then indicates that the roentgen rays after passing through a subject suffer not only quantitative but also qualitative changes.

Apart from the blackening coefficient of the film which as is seen depends on the proper exposure, the development of the film is of no less importance. Errors of exposure can often be corrected at development. This applies especially to overexposed films with intensifying screens. The best developer is the metolhydroquinone of the following formula:

"Agfa" metol	4.0
"Agfa" hydroquinone	9.0
Natr. sulfuros. cryst.	4.0
Pot. carbonic, pur.	62.0
Pot. bromat.	6.0
Aqua dist.	1000.0

The optimum temperature corresponds to 18°C. In case of proper exposure, the maximum

contrast is reached with five minute developing, while if the developing is carried to 7.5 minutes a fogging of the film ensues.

In a final series of experiments the influence of the hardness of the roentgen rays on the roentgen appearance of various pulmonary lesions with and without intensifying screen was analyzed. Small foci and cavities of the lungs were best visualized with soft roentgen rays, the optimum voltage (with intensifying screens) corresponding to 50 to 60 kv.—*T. Leucutia.*

DUHEM and BERNARD. Métastase pulmonaire d'un chorio-épithelio-placentome du testicule droit. (Pulmonary metastasis of a chorio-epithelio-placentoma of the right testicle.) *Bull. et mém. Soc. de radiol. méd. de France.*, Oct., 1929, *17*, 250.

A case of pulmonary metastasis is presented occurring in a man twenty-four years of age, who two years previously was operated on for a malignant tumor of the right testicle (chorio-epithelio-placentoma). Both lungs were studded with round nodules of from 3 to 8 cm. diameter.

Following roentgen therapy there was no improvement. Attention is called to the fact that the tumor is of a very rapidly progressive character.—*T. Leucutia.*

DIDIÉE. Un cas de métastase de sarcome dans le poumon et dans le cerveau. (A case of sarcoma metastases in the lung and brain.) *Bull. et mém. Soc. de radiol. méd. de France*, Nov., 1929, *17*, 272–274.

A man forty-eight years of age was operated on in 1923 for a tumor of the left hip which on microscopic examination proved to be a very malignant sarcoma. Six years later metastases appeared in the chest and brain. The pulmonary metastasis was in the form of a huge tumor of the right upper lung. The diagnosis was difficult on account of the long time which had elapsed between the primary lesion, and the appearance of the metastasis.—*T. Leucutia.*

BARREAU and PIFFAULT. Hématome calcifié de la plèvre. (Calcified hematoma of the pleura.) *Bull. et mém. Soc. de radiol. méd. de France*, Nov., 1929, *17*, 270.

A huge calcified hematoma of the pleura is described in an officer who during the war sustained an injury to the chest. The case is described because of its curiosity.—*T. Leucutia.*

WAHL, RUD. Zur Klinik und Röntgenologie der Lugenhernie. (Contribution to the clinic and roentgenology of lung hernia.) *Fortschr. a. d. Geb. d. Röntgenstrahlen*, Oct., 1929, *40*, 665–671.

A case of hernia of the lung is described in a man twenty-nine years of age who fell 9 meters, suffering cerebral concussion and fractured ribs. A roentgen examination of the chest six weeks later revealed an unusual hernia of the left lung (through the fractured ninth rib). The condition was exceedingly well demonstrated in the anteroposterior view with the patient in deep inspiration and by holding a heavy object so as to increase the intrathoracic pressure.

The case is described because it is the only one found in the literature in which a roentgen examination was made.—*T. Leucutia.*

DARBOIS and SOBEL. Note sur un cas d'éventration post-opératoire. (A case of post-operative eventration.) *Bull. et mém. Soc. de radiol. méd. de France*, Oct., 1929, *17*, 248–250.

A case of eventration is described in a woman sixty-two years of age who thirty years previously was operated upon for a uterine fibroid. The eventration is at the site of the scar below the umbilicus and at roentgen examination it was found that the sac contained the terminal portion of the ileum, the cecum and the transverse and part of the descending colon.

The case is interesting because it has produced practically no symptoms.—*T. Leucutia.*

ABDOMEN

MOORE, ALEXANDER B. Benign lesions in cardiac portions of esophagus and stomach; roentgenologic diagnosis. *J. Am. M. Ass.*, Jan. 4, 1930, *94*, 12–15.

Benign lesions in the cardiac portions of the esophagus and the stomach comprise chiefly cicatricial strictures, cardiospasm, diverticula, non-malignant new growths, ulcers and diaphragmatic hernias.

Cicatricial strictures are usually from drinking caustics but may result from typhoid ulceration or vomiting of pregnancy. Those from caustics are mostly in the upper third, the others in the lower third. The typical roentgen feature is the smooth-walled, inverted cone of barium which trickles through the constriction in a direct line. Cardiospasm and cancer must be eliminated.

Cardiospasm is relatively common. The barium shadow terminates in a rounded cone. Proximal dilatation is marked and the esophagus may be elongated as well.

Esophageal diverticula at the lower end are rare. When present they occur at the anterior wall as a finger-like projection to the left. Diverticula of the upper third of the stomach are not uncommon and must be distinguished from the pseudo-diverticulum or accessory pocket of a perforated ulcer. Gastric diverticula frequently show malignant change.

Syphilis of the esophagus is extremely rare, but gastric syphilis is fairly common. The lesion in the cardia is usually part of a lesion in the distal portion of the stomach.

Benign tumors of the esophagus are pathological curiosities. Benign gastric tumors commonly exist in the distal two-thirds, but occasionally are found in the cardia.

Ulcers in the lower part of the esophagus are usually small superficial erosions. Gastric ulcers are rare in the cardia and have never been seen above the level of the esophageal opening.

Herniation of the stomach through the diaphragm may be congenital or traumatic. In the former there is usually a short esophagus, a movable diaphragm, and a gas bubble above the diaphragm before the administration of the barium. The barium lags at the lower part of the esophagus and then enters the cardia which is obviously above the diaphragm. Traumatic hernias are on the left side. The rupture may be at any point. The barium enters the cardia without delay but then outlines the deformed area partly above and partly below a fixed diaphragm which is difficult to trace. In the diagnosis of either type of hernia the horizontal and the Trendelenburg positions should be employed. Eventration, which the author believes is rare, must be ruled out.—*G. R. Miller.*

Long, Charles-Francis. Rumination in man. *Am. J. M. Sc.*, Dec., 1929, *178*, 814–822.

Rumination or the ability to regurgitate food from the stomach into the mouth is the subject of this interesting paper. Six cases of this condition are reported.

Clinically, adult rumination is uncommon. It is usually found in individuals of a neurotic tendency with voracious appetites and who usually eat rapidly and swallow their food without proper mastication. Rumination generally occurs from fifteen to thirty minutes after a large meal and may continue for a half to one hour. The individual may or may not have any selectivity for the food regurgitated. The food has the same taste as when first eaten. Rumination automatically ceases when the food begins to taste sour. It is not accompanied by nausea. Only in rare instances can it be either voluntarily started or stopped.

One of the 6 patients studied was an actor whose livelihood depended upon his ability to ruminate. This individual presented an excellent opportunity to study the mechanism of rumination which was done by means of fluoroscopic observation. As a result of such an examination the author came to the following conclusions:

1. Pressure changes in the thorax seemed to play no part. (Toussaint who made exhaustive studies of rumination in the cow concluded that there was a reduction in intrathoracic pressure during the act.)

2. During the rumination the stomach empties itself by a diminution in size in all diameters, which is probably an expression of both the tightening of the abdominal muscles and the squeezing contraction of the gastric musculature.

3. The bolus is delivered to the mouth by strong rhythmic contractions of the lower portion of the esophagus, which are squeezing in type.

4. No evidence of organic or functional hourglass stomach or cascade stomach was noted.—*Karl Kornblum.*

Hânganut, M., and Dragulescu, I. Indicele epigastric; raportful morfologic dintre cutia toracica si stomac. (The epigastric index; the morphologic relation of the stomach to the thoracic cage.) *Clujul med.*, Nov., 1929, *10*, 513–515.

In a rather large number of cases the authors analyzed the relation between the roentgen form of the stomach, especially gastroptosis, and the thoracic cage.

The stomach was divided, following the method of Knud Faber, into the following four groups: (1) stomachs with both curvatures above the umbilicus; (2) stomachs with the lesser curvature above and the greater curvature below the umbilicus; (3) stomachs with the

lesser curvature 2 cm. below the umbilicus, and (4) stomachs with the lesser curvature more than 2 cm. below the umbilicus. This last (group 4) constitutes the true type of gastroptosis. Its frequency was 1:20 for men; 1:4 for nulliparas and 1:2 for multiparas. In dyspeptics the frequency of gastroptosis was double.

In a second series of investigations the relation of gastroptosis to the different types of thoracic cage was analyzed by making use of the epigastric index (figured according to Knud Faber).

It was found that in men and nulliparas the form and length of the stomach are in direct relation to the thoracic configuration, in that persons with a large thoracic circumference and a high epigastric index present a short and slightly oblique stomach, while the persons with narrow thorax and small epigastric index present an elongated stomach.

The factors which may modify this relation are (1) repeated pregnancies in women (the epigastric index in group 4 of nulliparas being 34 and in multiparas from 42 to 60); (2) nutritional state of the individual, and (3) atony of the stomach.—*T. Leucutia.*

ALVAREZ, WALTER C. What is the risk of insuring applicants with peptic ulcer? *Am. J. M. Sc.*, Dec., 1929, *178*, 777–796.

Much statistical data is brought forth bearing upon the problems of incidence, diagnosis and results of treatment in peptic ulcer, with special reference to the insurance risk of patients suffering from such lesions.

As to incidence, in 2000 necropsies performed at the Mayo Clinic scars of peptic ulcer were found more or less unexpectedly in 3.4 per cent, while open and apparently active ulcers gave a percentage of 7.4. In 163 of the 2000 patients an operation had been performed for ulcer.

The diagnosis of ulcer is made roentgenologically in 3.3 per cent of the patients who register at the Clinic, or in 15.5 per cent of those who complain of indigestion. Statistics gathered by the author several years ago show that the average practitioner, unaided by expert roentgenologists, will make the diagnosis in only one-third of the cases suffering from peptic ulcer.

The danger of death from the major complications of ulcer, namely hemorrhage and perforation, is small.

Many of the patients with chronic ulcers must eventually be operated on and that carries a risk. For the first few years after operation the results are generally good, but as years pass an increasing number of the patients relapse. Figures suggest that if a patient operated on for duodenal ulcer can get past the sixth year without recurrence, his outlook will be good, while a patient with gastric ulcer will be fairly safe if he gets past the eighth year without recurrence. Five to 10 per cent of surgical cases have to be operated on again and many become more or less incapacitated. It must be concluded that even the best of surgical treatment will not entirely erase that remarkable tendency to recurrence, perhaps hereditary, which is seen in a number of patients with ulcer. Perhaps 2 per cent of all patients who submit to gastroenterostomy will develop chronic gastrojejunal ulcers.

The pictures of gastric and duodenal ulcer are so similar that a differentiation clinically is not usually possible. The decision must generally be made by the roentgenologist. The odds, however, are 8 to 1 in favor of duodenal ulcer.

From the standpoint of insurance risk as well as clinically, gastric ulcer is far more important than duodenal ulcer. Aside from the higher risk of operation for gastric ulcer there is always the question of malignancy in association with this lesion which does not enter the consideration of duodenal ulcer. In spite of many arguments to the contrary the author regards the possibility of malignancy developing in an ulcer a real danger. But as he says, it is not a question as to whether a gastric ulcer will develop into a cancer but whether or not the lesion which looks like an ulcer is not already malignant. There are no criteria aside from microscopic examination by which this decision can be made in the early lesion. It is impossible in many cases to distinguish even at operation between benign and malignant ulceration. Ulcers larger than a half dollar are almost always carcinoma. It would seem, therefore, that the only way in which we can ever hope to get at early cancer of the stomach is to excise gastric ulcers. The only way in which to cure cancer of the stomach is to operate on healthy looking men and women with a slight but definite irregularity in the outline of the barium filled stomach.

Persons past forty years with recently acquired indigestion of any kind are particularly

undesirable as risks. Only long experience can give exact information as to what premiums patients with gastric ulcer should pay for insurance. From the statistics presented, it would seem obvious that no one over thirty years of age should ever be accepted when the symptoms have been of short duration and when a "cure" has been but recently accomplished.—*Karl Kornblum.*

Jordan, Sara M. Gastric ulcer and cancer. *J. Am. M. Ass.*, Nov. 23, 1929, *93*, 1642–1648.

If gastric syphilis, gastritis and the less common tumors are eliminated all lesions of the stomach fall into one of three groups: (1) frankly malignant; (2) frank ulcer, and (3) questionable ulcer or carcinoma.

Clinically and roentgenographically 133 gastric cases at the Lahey Clinic were studied and classified. Those cases (66) which showed evidence of frank malignancy were operated upon when possible. The remaining cases (67) were placed under strict routine medical treatment. All cases of tractable ulcer should show within thirty days: (1) freedom from symptoms; (2) absence of occult blood in the stools; (3) complete normality of contour and function of the stomach by roentgen examination. Cases (13) which failed to exhibit these three evidences of healing were operated upon, because in these cases the possibility of malignant change exists.

Statistics concerning symptoms, incidence, and location of the lesion are given. Drawings illustrate the changes observed roentgenologically in some of the cases. Of interest is the fact that duration of symptoms does not necessarily determine the tractability of the lesion.—*G. R. Miller.*

Ledoux-Lebard, R., and Calderon, Garcia. Les images d'évacuation et le diagnostic de précision dans l'examen radiologique du tube digestif. (Evacuation images and precision diagnosis in roentgen examination of the digestive tube.) *Bull. et mém. Soc. de radiol. méd. de France*, Nov., 1929, *17*, 264–268.

The following procedure is advocated for the roentgen examination of the duodenal bulb: The patient is roentgenoscoped in a standing position and the bulb is studied for deformity. If the bulb shows a good filling palpation is applied and the patient is examined in frontal and oblique positions. Not infrequently a niche is detected by means of forcing the barium out of the bulb. In such instances the examination is followed by the taking of several roentgenograms in the standing position. Whenever the bulb shows a normal appearance and the palpation fails to elicit the presence of niches, serial roentgenograms are taken with compression. This can be done either by (1) localized graded or (2) by indirect compression.

A cylindrical palpator, a rubber balloon or the Åkerlund device (with rotating Bucky diaphragm) are used for the localized compression, while the indirect compression is practised by simply placing the patient in ventral decubitus in which instance the patient's own weight exercises the necessary pressure on the bulb.

Eight or 12 serial roentgenograms are taken at half minute intervals. The use of a Bucky diaphragm (with half second exposures) leads to excellent detail.—*T. Leucutia.*

Belot, Kimpel and Nebout. Radiographie d'un diverticule du duodénum. (Roentgenography of a duodenal diverticulum.) *Bull. et mém. Soc. de radiol. méd. de France*, Nov., 1929, *17*, 275.

A case of duodenal diverticulum is briefly described in a man thirty years of age. The condition was discovered accidentally. No clinical symptoms have been present.—*T. Leucutia.*

Ronneaux, G., and Tsang. Gros diverticule du duodénum à symptomatologie clinique imprécise. (Large diverticulum of the duodenum with vague clinical symptomatology.) *Bull. et mém. Soc. de radiol. méd. de France*, Nov., 1929, *17*, 260–262.

An enormous diverticulum of the duodenum was accidentally observed in a man seventy-five years of age who came for roentgen examination for carcinoma of the stomach.

The interesting feature is that the diverticulum has produced practically no symptoms.—*T. Leucutia.*

Hodges, Fred M. The roentgen ray in the diagnosis of mucous colitis. *Radiology*, Nov., 1929, *13*, 383–387.

In this study the author considered the clinical as well as the roentgenographic aspects of

mucous colitis. He concludes that mucous colitis can probably be demonstrated roentgenographically in about 1 per cent of all gastrointestinal cases. The condition may at times simulate disease of the appendix, or gallbladder, diverticulitis, splenic disease, etc., and not infrequently operations are done when the real trouble is this peculiar neurosis or allergic phenomenon. The string sign, first fully described by Crane, is probably pathognomonic of mucous colitis. The absence of this sign does not, however, exclude the condition. The appearance of the colon after a bowel movement following a barium meal or enema does not apparently closely simulate this disease. The roentgenologist is probably justified in making a diagnosis of mucous colitis when a typical string sign is present, whether or not he can obtain a history of the passage of mucous casts. He must be careful, however, not to overlook other serious pathology in the abdomen when this form of colitis is found.—*J. D. Camp.*

LUBOSCH, W. Das Rektum des Menschen im Röntgenbild und in anatomischen Praparat. (The human rectum in the roentgenogram and in anatomical specimens.) *Fortschr. a. d. Geb. d. Röntgenstrahlen*, Oct., 1929, *40*, 674–678.

The old division of the rectum into three parts serves a better purpose than the present classification into the pars sacralis and pars perinealis. Both roentgen examination and anatomical specimens reveal that the pars sacralis consists of an upper portion reaching down to the folding of the peritoneum and of a lower extra-peritoneal portion. The pars perinealis when well differentiated represents the ampulla, but since a differentiation does not always occur it is wiser to use the term of "pars ampullaris" instead of "ampulla recti." The reason why modern anatomical testbooks call the lower portion of the rectum "ampulla" is not clear. It is true that roentgenograms reveal that following an enema the lower portion of the rectum may also be filled, there being even evidence of an isthmus separating the lower portion from the upper portion of the rectum, but this constitutes no justification for the use of the term "ampulla."—*T. Leucutia.*

JAFFÉ, RUDOLF. Über röntgenologische Darstellung der Milz (Lienographie) und Leber. (Roentgenologic visualization of the spleen (lienography) and liver.) *Fortschr. a. d. Geb. d. Röntgenstrahlen*, Oct., 1929, *40*, 692–693.

Oka recently reported the roentgen visualization of the spleen by intravenous injection of thorium dioxide sol in experimental animals. Radt likewise experimented with the same preparation for nine months, but he did not publish his results since the experiments are not yet completed. The recent report of Oka has induced the author to give a brief résumé of the present status of Radt's work (before the experiments are completed).

Since thorium dioxide (thordiol) is stored with preference by the reticulo-endothelial system, Radt conceived the idea that the cells of the spleen and the Kupffer cells of the liver might do the same thing. Therefore he injected thorium dioxide solution intravenously into different experimental animals and was able to obtain a good roentgen visibility of both the spleen and liver.

The method is not applicable to humans since thorium dioxide is highly poisonous and since the metabolic changes resulting from its storage in the reticulo-endothelial system are not yet known.—*T. Leucutia.*

GYNECOLOGY AND OBSTETRICS

COTTE, G. L'exploration de l'uterus et des trompes apres injection de pipiodol. (Exploration of the uterus and tubes by injection of lipiodol.) *J. de radiol. et d'electrol.*, June, 1929, *13*, 321–332.

The author injects the lipiodol under a pressure of 20 to 25 mm. Hg and hospitalizes the patient for a period of twenty-four to forty-eight hours following the injection.

The exploration of the uterus and tubes by means of lipiodol is of value: (1) from a physiologic standpoint, since it permits the study of phenomena (peristalsis, contractions, etc.) which cannot be otherwise observed; (2) from a clinical standpoint, since it permits a diagnosis in certain obscure pelvic conditions, and (3) from a therapeutic standpoint, especially in occlusion of the tubes.

The most important pelvic conditions in which lipiodol is of a diagnostic aid are the pelvic tumors (differential diagnosis including fibroma, cyst of the broad ligament, ovarian tumor, chronic adnexitis and hematosalpinx),

certain cases of dysmenorrhea and amenorrhea, habitual abortion and especially sterility.

The author has used pelvic lipiodol since February, 1925, in 200 cases without one single accident. Still, one should always bear in mind that the injection of lipiodol represents an intra-uterine intervention and that a certain danger is connected with any such intervention. This applies especially in cases of salpingitis in which not infrequently an exacerbation of the inflammation is observed. —*T. Leucutia.*

GENITOURINARY SYSTEM

ROSENO, A. Die intravenöse Pyelographie. II. Mitteilung. Klinische Ergebnisse. (Intravenous pyelography. II. Clinical findings.) *Klin. Wchnschr.*, June 18, 1929, *8*, 1165–1170.

In another place (see abstract, this Journal, September, 1929, p. 283) Roseno in association with Jepken published the experimental results in animals of intravenous pyelography by means of an iodine urea compound. In the present article the results of the clinical application in humans are given.

Indications. Intravenous pyelography is of great advantage in all those instances in which the usual pyelography by retrograde injection is contraindicated as, for example, in urethral stricture, atrophy and tuberculosis of the bladder, occlusion of one of the ureters, tuberculosis of the kidneys, etc.

Physiologic and Pharmacologic Consideration. Normally the function of the kidney consists in excretion of the urine without there being a storage of the excreted fluid, as is the case in the gall-bladder. This means that after the injection of the opaque medium the excretion of this substance occurs so fast that no roentgen visualization is possible. In order to produce a greater concentration of the iodine within the excreting kidney, the author had added urea which in this particular instance serves two purposes: first, it forms a sort of a carrier for the iodine, directing it towards the kidney and second, it acts as a diuretic in increasing the permeability of the kidney filter.

Technique. The idiosyncrasy for iodine is tested (by means of a skin test) the day previous to the examination. If no such idiosyncrasy is present the solution (the nature and concentration of which is not described) is injected within five to fifteen minutes intravenously. The bladder at the time of injection must be kept full so as to produce a stasis in the kidney pelvis and thus delay the excretion of the opaque medium. Roentgenograms are taken immediately, three hours and five hours following the injection.

Reactions. There is a sensation of pressure in the head and occasionally in the chest associated with a feeling of faintness (such as observed following the injection of calcium salts) lasting for a few minutes following the completion of the injection. A little later there is a sensation of thirst sometimes necessitating the taking of fluids. In other instances there is evidence of headaches and a slight elevation of temperature occasionally lasting for over twenty-four hours. Within forty-eight hours all reactive symptoms disappear.

Normal Intravenous Pyelograms. The normal pyelogram obtained after intravenous injection of the contrast medium is different from that obtained by the retrograde injection in that it appears smaller and less distorted. This, in the author's estimation, is due to the fact that mechanical distention is entirely absent in intravenous pyelography. A good roentgen visualization of the kidney pelvis is obtained immediately following the injection due to a flooding of the blood stream by the opaque medium (the so-called "flooding picture") and again within three to five hours following the injection due to the excretion of the oqe^{d}a^{n} medium (the so-called "excretion picture"). The ureters appear as faint shadows, while the bladder is quite opaque.

The Intravenous Pyelogram of Pathologic Cases. The author includes 12 roentgenograms to illustrate the value of intravenous pyelography in various pathologic conditions. In case of complete occlusion of one of the ureters (by stone, kinking or tuberculous stricture) it is possible to obtain a good visualization of the kidney and portion of the ureter above the stricture. In stenosis underneath the ureteral ostia (urethral stricture, hypertrophy of the prostate) likewise a good visualization of the urinary tract is obtained because of the stasis produced by the stenosis. In kidney and ureteral stones one may exactly localize the site of the stones and also the type and extent of the stasis proximal to the stone, much information being obtained at the same time

concerning the function of the diseased as well as of the opposite normal kidney. In anomalies of the uropoietic system the type and extent of the anomaly and the complications resulting therefrom can be easily determined. In tuberculosis of the kidney, in addition to an impaired reflectoric excretion, tuberculous cavities in the region of the calyces and parenchyma may be demonstrated.

In renal tumors as well as in cystic kidneys, the retrograde pyelography (with eventual pneumokidney) is of greater advantage. Intravenous pyelography, because of the nearly complete loss of excretion, leads here to only poor visualization of the urinary tract. A great majority of the so-called "functional ureteral kinkings," and Hunner's "ureteral strictures" are artefacts, produced most probably by the manipulation during the retrograde pyelography.

The conclusion is reached that intravenous pyelography with iodine-urea forms the synthesis of functional kidney diagnosis permitting a typographic-anatomic vizsualiation of the excretory urinary paths. Thus the roentgen exploration of the function of the uropoietic system is solved.—*T. Leucutia.*

ROSENO, A. Die intravenöse Pyelographie. (Intravenous pyelography.) *Klin. Wchnschr.*, Aug. 27, 1929, *8*, 1623.

The dose of opaque substance injected by the author for intravenous pyelography is briefly given. The preparation is called "pyelognost" and is produced by Gehe and Co., Dresden. Sixty-three gm. is injected in a normal patient of from 50 to 90 kg. weight; 1.5 gm. is subtracted for every kilogram body weight under 50 kg. and 1.5 gm. is added for every kilogram body weight over 90 kg.—*T. Leucutia.*

SWICK, M. Darstellung der Niere und Harnwege im Röntgenbild durch intravenöse Einbringung eines neuen Kontraststoffes, des Uroselectans. (Roentgen visualization of the kidney and urinary paths, by means of the intravenous administration of a new contrast substance, uroselectan.) *Klin. Wchnschr.*, Nov. 5, 1929, *8*, 2087–2089.

Selectan-neutral, a preparation made by Binz and Räth, was used for a long time by the medical division of the Altona Krankenhaus for the treatment of coccus infections of various types. The good results obtained in infections of the gall-bladder and urinary tract made it seem probable that the excretion of this substance is chiefly through these two tracts, a fact which led to the investigation of the value of selectan-neutral (containing 54 per cent iodine) in the roentgen visualization of the biliary and urinary system. The first experiments carried out in animals gave no roentgen visibility of the gall-bladder but there was a rather good outlining of the urinary paths. After determining the tolerance dose for animals the method was applied to humans. In all instances a good visualization of the urinary bladder and in a few instances also of the kidney and ureters was obtained.

Encouraged by these first results Binz and Räth, after replacing a methyl group of the neutral selectan with sodium glycin and after reducing its iodine content (so as to produce a better solubility) prepared a new substance which they called uroselectan. This substance proved entirely harmless, of good solubility and was excreted by the kidney in a concentration sufficient to produce good roentgen visibility. Its tolerance was 7 gm. per kilogram body weight for mice and 3 gm. for rabbits, placing the upper limit of a human of 60 kg. weight around 180 gm. Considering that the preparation contains 42 per cent iodine this means a total dose of 75.6 gm. iodine. It was found during the course of the investigations that in normal kidney function at least 85 to 95 per cent of the iodine is excreted in the urine within fifteen minutes following the injection.

Not more than 120 c.c. of a 30 to 34 per cent solution (that is circa 40 gm. of the substance) is used for intravenous pyelography in humans. The injection is made into the arm vein within three to five minutes; 20 c.c. Record syringes are used for this purpose, as many of the syringes being kept ready as necessary for the injection of the entire amount of the solution. The procedure is carried out on a roentgen table and the first roentgenogram is taken within five to ten minutes following the completion of the injection. Two further roentgenograms are taken at one-half hour intervals, the bladder having been emptied in the meantime (so as to produce a better visualization of the lower ureters, as a rule obscured by the superimposing bladder shadow). In normal

kidneys the excretion of the opaque medium is completed within three hours following the injection while in case of disturbed renal function it may last for six to twenty-four hours or longer. If there is marked destruction of the kidney the roentgen visualization may become entirely impossible.

No untoward effects were observed from the application of the method in a series of 119 cases, of nearly all types of kidney conditions. One girl with bilateral pyelonephrosis died within nineteen hours following injection but it was thought that since a uremia had existed previous to the injection this was responsible for the outcome.

Eight roentgenograms are reproduced in order to show the great practical value of intravenous pyelography by means of uroselectan.—*T. Leucutia.*

von Lichtenberg, A., and Swick, M. Klinische Prüfung des Uroselectans. (Clinical application of uroselectan.) *Klin. Wchnschr.*, Nov. 5, 1929, *8*, 2089–2091.

In a recent discussion (at a urologic congress) of Roseno's work on the value of intravenous pyelography, von Lichtenberg took a rather pessimistic standpoint. By this he did not mean to underestimate the idea of intravenous pyelography but expressed doubt that a suitable medium for injection would be found. Yet, Roseno, by emphasizing the physiological and pathophysiological phenomena, obtained marked results in this respect. A further important contribution was made by Swick (see above abstract).

In comparing the intravenous pyelography (by means of uroselectan) with the routine retrograde pyelography the authors attempted to determine at the St. Hedwig Krankenhaus, aided by Rave—roentgenologist of the institute—in how far the two methods agreed and what practical conclusions could be drawn. Of the 84 cases examined, 35 were later checked at operation and one at post mortem.

In all instances a good roentgen visibility of the urinary tract was obtained. If there was no kidney shadow demonstrable, there was either no kidney present or the function was greatly or entirely destroyed. The functional disturbances of the urinary tract could also be studied with great accuracy.

Of the 84 cases examined (this number later increased to 160), in 75 per cent good information concerning the best therapeutic procedure was obtained from intravenous pyelography alone; in the rest the examination had to be supplemented by cystoscopy, catheterization of the ureters, and pyelography. The functional test as estimated from the roentgen findings likewise led to positive information in 75 per cent of the cases.

Intravenous pyelography is indicated: (1) in all instances in which cystoscopy, ureteral catheterization and direct pyelography are contraindicated either for anatomical, pathological or technical reasons; (2) in all cases with ureteral occlusion, and (3) in all instances in which the application of direct pyelography is associated with a certain risk to the patient.

In the cases with limited kidney function direct pyelography by the routine procedure leads on account of the better contrast to more satisfactory results.

Since 95 per cent of the injected iodine is excreted in the urine within six to eight hours, it was attempted to find whether the rate and the percentage of the iodine excreted could not be used as a basis of a functional test of the uropoietic system. Three methods were employed for this purpose: (1) the determination of the excreted iodine; (2) the quantitative determination of the excreted uroselectan, and (3) the determination of the specific gravity of the urine, this increasing proportionately with the amount of iodine present. So far it has been impossible to find out which of the three methods would be of practical value.

The association of pyelography with pyeloscopy is indicated also in the intravenous application of the method.

The authors have tried to administer uroselectan also per os but this procedure has proved unsatisfactory.

The conclusion is reached that the intravenous pyelography by means of uroselectan is of considerable value in the diagnosis of all urologic conditions. Moreover it permits the elaboration of new methods for the estimation of the functional disturbances of the uropoietic system.—*T. Leucutia.*

Hryntschak, Th. (Studies on roentgenography of the renal parenchyma and pelvis by intravenous methods.) *Ztschr. f. Urol.*, 1929, *23*, 893. Abstract in *Cluj. med.*, Feb., 1930, *11*, 108–109.

The author has experimented on animals since 1925 with numerous opaque media for the visualization of the parenchyma and pelvis of the kidney.

The following criteria were found to be of paramount importance: (1) the opaque medium must be entirely harmless to the renal tissues; (2) it must be nontoxic; (3) it must possess sufficient contrast (iodine or bromide); (4) it must represent a stable preparation (so that iodine or bromide is not liberated in the organism); (5) it should be neutral, soluble in water (to at least 20 per cent) and permit of sterilization by boiling, and (6) it should be excreted in its entirety in the shortest possible time.

The preparations used by the author were made synthetically. Simultaneously with the intravenous injection of the opaque medium, pituitrin was administered (intramuscularly) in order to increase the power of concentration of the kidney, and atropine to decrease the peristalsis of the pelvis and ureters.

Good results were obtained although the method needs further perfection.—*T. Leucutia.*

SWICK, M. Intravenous urography by means of uroselectan. *Am. J. Surg.*, Feb., 1930, *8*, 405–414.

After a brief description of the procedures which led to the discovery of uroselectan (by Binz and Räth), the author defines the characteristics of this compound as follows: Uroselectan is nontoxic, very soluble in water, neutral in its reaction and under normal conditions excreted as such through the genitourinary tract within eight hours practically to the extent of 90 to 100 per cent. The iodine in the molecule exists in a very stable organically bound state, this explaining why iodism has never been observed. Its tolerance is exceedingly great; theoretically 180 gm. of the substance—in terms of iodine 75.6 gm.—can be administered to a 60 kg. individual.

The method of administration is as follows: For an adult from 33 to 40 gm. is dissolved in double-distilled water to a volume of 100 c.c. The solution is filtered twice through ordinary filter paper and sterilized in a water bath or autoclave at 15 lb. pressure for one-half hour. A child of seven years receives one-half and a child of two years one-quarter of the dose administered to an adult. The injection is made in two stages at intervals of three to five minutes by using five to six syringes previously sterilized in distilled water. The first roentgen examination is made fifteen minutes after the last injection, the second about twenty to thirty minutes after the first roentgenogram and the third a corresponding period after the second. In disturbances of the kidney function, subsequent films are taken at intervals of from two to four hours.

The reaction consists in thirst and generalized warmth, particularly involving the face and bladder region, and occasionally nausea. Shivering and vomiting of short duration occurred in a case of nephrosis. A child ten years of age died shortly after the injection but here the uremia which had existed a long time previous to the injection was probably responsible for the result.

Intravenous urography is indicated whenever ureteral catheterization is dangerous or mechanically impossible, in cases of infection of the lower genitourinary tract, in the presence of bleeding, in cases of implanted ureters and in children.—*T. Leucutia.*

KIELLEUTHNER. Ueber eine neue, aussichtsreiche Untersuchungsmethode an den Harnorganen (Uroselektan). (On a new promising method of examination of the urinary organs (uroselectan).) *München. med. Wchnschr.*, Feb. 14, 1930, *77*, 276–278.

The author has used uroselectan for intravenous pyelography for the past three months in a series of 34 cases.

The technique of procedure was as follows: 33 to 40 gm. of the substance was dissolved in sterile distilled water at room temperature so as to make 100 to 120 c.c. The solution was filtered twice and sterilized for twenty minutes. It was then slowly injected in one arm and roentgenograms were taken 10 to 15, 30 to 40 minutes and in case of disturbed kidney function, one, two and several hours later. All roentgenograms obtained were very satisfactory and there were no ill effects from the injection. The method is of special value in all instances in which direct pyelography is impractical, in children, in ureteral stones, malformations, and in differentiation from certain abdominal tumors. It is contraindicated in bilateral affections of the kidney

and in thyrotoxicosis (danger of iodism).—*T. Leucutia.*

Bergerhoff, W. Intravenous injection of contrast medium for pyelography; significance of this method for internal medicine. *Med. Klin.*, Feb. 14, 1930, *26*, 232. (Abst. from *J. Am. M. Ass.*, April 26, 1930, *94*, 1360.)

Bergerhoff points out that the older method of pyelography in which the contrast medium was brought directly into the urinary passage was not physiologic. Another method has therefore been perfected by which a contrast medium that consists of a combination of urea and of iodine is injected into the cubital vein and is excreted again through the urinary system. Not only does this contrast medium facilitate roentgenoscopy but its elimination reveals the functional activity of the urinary system. The author further enumerates the conditions in which this method of pyelography should be used and also the cases in which it is contraindicated. Following a description of the mechanism of the injection of the contrast medium and of the roentgenographic technic, he reports several cases that illustrate the great value of this method. The author points out that this method of pyelography makes it possible for the physician who is not a specialist in urology to diagnose disorders of the urinary system, and consequently it enlarges the field of his activity. Indications for operative treatment can now be more precise than before this technic was perfected.

Béclère, H., Porcher, P., and Henry, Robert. Premiers résultats de la methode de Lichtenberg. (Pyélo-urétéro-cystographie par injection intra-veineuse.) (First results of Lichtenberg's method (pyelo-ureterocystography by intravenous injection).) *Bull. et mém. Soc. de radiol. méd. de France*, Feb., 1930, *18*, 79–81.

The authors experimented at the Vaugirard Hospital with intravenous pyelography by using the preparation employed by Lichtenberg at St. Hedwig's Hospital in Berlin. This preparation consists of an iodized substance derived from pyridine. It is made in the form of a water soluble powder, it is absolutely nontoxic and its excretion begins within five minutes following the intravenous injection.

The roentgenograms which were taken by the authors ten minutes following the injection are not very sharp but they demonstrate clearly the kidney pelvis as well as the ureters and bladder.

The method has two advantages: First, it permits a study of the morphology of the kidney pelvis, ureters and bladder in all cases in which ureteral catheterization is impossible or contraindicated, and second, it gives information with regard to the intimate phenomena of urinary excretion.

The technique is as follows: 40 gm. of the powder (called uroselectan, manufactured by Shéring) is dissolved in 80 c.c. of double distilled water. After the addition of 20 c.c. more of double distilled water the solution is filtered through a regular filter paper or sterile gauze; then it is placed for 20 minutes in a water bath, is refiltered and maintained at 37°C. The intravenous injection is performed according to the usual technique (in the arm vein) except that following the injection of the first half of the solution (50 c.c.) a three-minute wait is made before injecting the second half.

The roentgenograms are taken ¼, ½ and 1¼ hours following the injection, the second roentgenogram as a rule showing the maximum contrast. In some of Lichtenberg's cases positive roentgenograms were obtained six and even twenty-four hours following the injection. —*T. Leucutia.*

Vallery-Radot, Pasteur, Dalsace, Jean, Nemours-Auguste and Dérot, Maurice. Nouveau procédé d'exploration radiologique des voies urinaires. (A new procedure for the roentgen exploration of the urinary tract.) *Presse méd.*, March 19, 1930, *38*, 385–387.

Osborne, Sutherland, Scholl and Rowntree in 1923 for the first time used sodium iodide orally and intravenously for the roentgen demonstration of the urinary tract. Volkmann in 1924, after experimenting with lithium iodide, sodium bromide and sodium iodide, arrived at the conclusion that sodium iodide is the most suitable of the three. Von Lichtenberg in 1924, Lenarduzzi and Pecco in 1927, and finally Roseno in 1929 made further contributions on this subject. The

method of Roseno consisted in the intravenous injection of sodium iodide in association with urea, this latter acting as a diuretic and thus producing a faster elimination of the iodine. Roentgenograms were taken within 15 minutes, 3 hours and 5 hours following the injection.

More recently von Lichtenberg and Swick made an important contribution to the method inaugurated by Osborne et al. in introducing "uroselectan." This product (prepared by Binz and Räth) consists of a sodium salt of pyridine with 42 per cent iodide organically fixed. One hundred c.c. of the solution is injected in two parts; first, 40 c.c. and three minutes later 60 c.c. The roentgenograms are taken 15 minutes, 45 minutes and 1 hour 15 minutes, or in the event of a functional disturbance of the kidney, 6 hours, 24 hours and even 36 hours following the injection of the opaque medium.

The authors investigated the value of the method of von Lichtenberg and Swick by injecting uroselectan intravenously into 2 rabbits and one guinea pig. The preparation was well tolerated (the maximum tolerance dose being 7 gm. per kilogram body weight in mice, and 3 gm. per kilogram body weight in rabbits, this giving a maximum dose of 180 gm. for a human of 60 kilogram weight).

As a result of the above animal experiments, uroselectan (40 gm. dissolved in 100 c.c. double distilled water) was injected also in one human, and roentgenograms were taken 1, 6, 16, 23, 41, 57 minutes, 1 hour 19 minutes, and 1 hour 33 minutes following the injection.

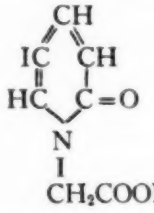
The conclusion is reached that the method of von Lichtenberg and Swick leads to a good roentgen visualization of the calyces, kidney pelvis, ureters and bladder. It also permits the evaluation of functional disturbance of the kidney. The method marks a real progress in the study of renal pathology.—*T. Leucutia.*

RAVASINI AND GORTAN. Il quadro radiografico delle vie urinarie mediante l'iniezione endovenosa con l'uroselectan. (Roentgenography of the urinary tract after intravenous injection with uroselectan.) *Radiol. med.*, March, 1930, *17*, 327–328.

The authors have used uroselectan in 10 cases of various pathological lesions such as mobile kidney, marked chronic cystitis, bilateral cystopyelitis in pregnancies, bilateral pyelonephrosis, stone of the kidney pelvis, double ureters, infected prostate, cystopyelitis in pregnancy, nine-month pregnancy with constricted kidney pelvis, and polycystic kidneys. The conclusion is reached that the preparation is entirely innocuous; in 2 cases there was temporary elevation of temperature but this was due, as already suspected by Lichtenberg, to the distilled water. Very good roentgen images of the urinary tract were obtained in all cases in which the renal function permitted sufficient elimination of the opaque salt. The method is indicated in all those instances in which usual pyelography cannot be performed. It also gives certain information of a physiologic character.—*T. Leucutia.*

ROTH, E. J. H., AND WRIGHT, H. W. S. Intravenous pyelography. *Brit. M. J.*, Apr. 26, 1930, *1*, 778–780.

Binz and Raeth, after substituting sodium glycin for a methyl group, and reducing the iodine content of selectan-neutral, obtained the preparation known as uroselectan (sodium 2 oxy-5-iod pyridine-N-acetic acid), the graphic formula of which is as follows:



This preparation is neutral, soluble in water to more than 50 per cent, and contains 42 per cent of iodine. It is an extremely stable chemical compound and its opacity to roentgen rays is excellent. It is possible to give an intravenous dose of 180 gm. to a man weighing 50 kilos, but for clinical purposes 40 gm. is sufficient to produce perfectly clear-cut shadows. For children, the dose is proportionately smaller. Up to the age of six, 10 to 12 c.c. of the 40 per cent solution, from six to ten years, 20 to 40 c.c. and from ten to fifteen years, 50 c.c. are injected.

The technique of injection was that employed by Swick and Lichtenberg. Roentgenograms were taken a quarter of an hour, three-quarters and one and a quarter hours after the injection. Important information was obtained by comparing roentgenograms of

a series and it is suggested that the use of serial changing cassette holders, working in conjunction with a Potter-Bucky diaphragm, might be of great advantage.

No ill effects were observed from the injection. There was a slight increase in the pulse rate and blood pressure with cramp in the anterior shoulder muscles, in a few instances, but always the symptoms disappeared within fifteen minutes. The method is perfectly safe, even in cases with marked decrease of renal function. The only known contraindications are anuria, uremia, and cases in which the liver as well as the kidney is grossly diseased.

In the authors' series of 60 roentgenograms they have noted that the shadow of the left kidney appears slightly less dense than that of the right. They have not succeeded, as others have done, in visualizing on screen examination the pelvic shadow accurately enough for pyeloscopy. On the roentgenograms, there was a satisfactory shadow after six minutes, and in fifteen minutes there was a perfectly clear outline of the whole of the urinary tract.

Uroselectan can also be used as a test of renal function, since it is easily recovered from the urine. On the addition of hydrochloric acid, it forms a heavy white precipitate when the p_H reaches 2.8 to 3. Chemical estimation, however, is not always necessary because the specific gravity is a very reliable guide to the amount of the drug present. It should reach between 1045 and 1050 within an hour.

The authors were able to confirm the experience of Lichtenberg according to which while an advanced non-infected hydronephrosis gives an excellent though perhaps delayed shadow, a pyonephrotic and infected or a congested kidney may give no shadow at all.

In conclusion, the opinion is expressed that intravenous pyelography by means of uroselectan will play an important part in urological diagnosis since it is both a reliable renal function test and a pyelographic contrast medium.—*T. Leucutia.*

Truchot. Présentation de quelques radiographies du système urinaire, obtenues après injection intra-veineuse d'urosélectan. (Presentation of a few roentgenograms of the urinary system obtained following intravenous injection of uroselectan.) *Bull. et mém. Soc. de radiol. méd. de France*, April, 1930, *18*, 171–173,

Uroselectan was used for intravenous pyelography in some 20 examinations of the urinary system. The method of injection was that employed by Lichtenberg. No ill effects were observed except for a slight sensation of heat in the head lasting for a period of ten to fifteen minutes.

The intensity of the shadow of the urinary tract was controlled roentgenoscopically and roentgenograms were taken at the peak of visibility of the image.

Four cases in which the application of intravenous pyelography led to correct diagnosis are presented and briefly discussed.—*T. Leucutia.*

Teposu, E. Insuficienta orificiului ureteral si reflux vesico-renal. (Insufficiency of the ureteral orifice and vesico-renal reflux.) *Clujul med.*, Dec., 1929, *10*, 579–585.

Two cases of vesico-renal reflux are described in detail. The first case occurred in a man fifty-five years of age who since 1916 had complained of bladder symptoms and who in 1925 and 1926 had had three successive operations. A diagnosis of sclerosis of the trigone (due to scarifications from the operations) was made and it was thought that this sclerosis was responsible for the vesico-renal reflux. Following an excision of the trigone the lesion apparently healed.

The second case is that of a girl fourteen years of age without definite etiology. The vesico-renal reflux was confined here to the left side.

In connection with these two cases the author discusses the mechanism of vesico-renal reflux and arrives at the conclusion that it may be the result of the following three factors: (*a* disturbance in the normal peristalsis of th ureter; (*b*) disturbance in the obliquity of th intramural portion of the ureter, and (*c*) insufficiency of the valvular function of the ureteral orifice.

The conditions which may lead to disturbance of the above factors are acute or chronic inflammations, tuberculosis, lesions of the trigone, uretero-cystoneostoma, prostatic hypertrophy, affections of the nervous system (tabes, poliomyelitis, multiple sclerosis) and spina bifida.

Cystography is the sovereign method of examination. The author as a rule injects 100 to 150 c.c. of a 30 per cent solution of sodium bromide.—*T. Leucutia.*

TEPOSU, E., and MURESANU, E. Consideratiuni asupra una suta interventii pentru calculoza vezicala. (Considerations of 100 interventions for vesical calculosis.) *Clujul med.*, Dec., 1929, *10*, 585–591.

One hundred cases of bladder stone were operated on at the surgical division of the University Hospital of Cluj since 1920. This rather high incidence of bladder stones is explained by the richness of the soil of Transylvania in calcium salts. According to age incidence it was found that the largest majority of stones (24.5 per cent) occurred in children less than ten years of age. The authors are of the opinion that this must be due to improper nourishment since the poorer classes were especially affected.

The roentgenograms of several unusual cases are presented, one of them illustrating a bladder stone which occupied nearly the entire pelvis.—*T. Leucutia.*

NERVOUS SYSTEM

ELSBERG, CHARLES A., and CONSTABLE, KATE. Tumors of the cauda equina; the differential diagnosis between new growths and inflammatory lesions of the caudal roots. *Arch. Neurol. & Psychiat.*, Jan., 1930, *23*, 79–105.

This paper is a study of the clinical features of lesions of the cauda equina, and is based upon the analysis of 45 cases. The author states that the size of intradural tumors of the cauda equina vary greatly, from 1 to 3 cm. There are well encapsulated meningeal and perineural fibroblastomas. Individual growths which involve the caudal roots or push the roots to one side fill the greater part of the lower end of the vertebral canal and because of their size are called giant tumors.

Extradural Tumors. Tumors of this location that compress the roots of the cauda equina usually derive from the bone or the intervertebral cartilages and are relatively infrequent. Various histological classifications are given. The incidence was about the same in males and females. Pain was the chief complaint in both groups. Motor weakness and bladder disturbance with some sensory and reflex disturbances were noted.

Roentgen Changes. These changes are occasionally observed and may be of considerable significance. No pathological changes due to disease are ever observed in neuritis but in giant cell tumors the enlargement of the vertebral canal is sometimes distinctly shown on the roentgenogram.

The author discusses the value of the manometric test and also the value of double punctures. He has taken a conservative attitude regarding the use of iodized oil and he is convinced that if thorough and repeated neurological examinations and complete manometric tests have been made with examination of the spinal fluid, injections of iodized oil are rarely if ever necessary for diagnosis of tumors that compress the spinal cord or the roots of the cauda equina. Only 8 cases were subjected to this procedure and he tabulates the point at which the oil was blocked and the point at which the tumor was found. There was some variation in the findings which was explained by the fact that ofttimes there is associated with these tumors an arachnoiditis which may be sufficient to block the fluid.

In his final discussion the author states that he feels that the use of iodized oil is not without danger. The fact that the oil remains in the canal for such a long time cannot do any good, but only harm.—*E. P. Pendergrass.*

ELSBERG, CHARLES A. Tumors of the spinal cord. Problems in their diagnosis and localization; procedures for their exposure and removal. *Arch. Neurol. & Psychiat.*, Nov., 1929, *22*, 949–965.

The author discusses the clinical manifestations, the physical findings and the laboratory tests that will aid in the diagnosis of spinal cord tumors. In discussing the indications for iodized oil, the author states that this procedure has been used more often than necessary and although it is valuable in the localization of a growth it is never necessary. If there is no clinical evidence of a subarachnoid block the iodized oil will pass freely upward and downward. The author thinks that iodized oil is a distinct irritant to the meninges.

The author discusses the surgical exposure and removal of spinal cord tumors.—*E. P. Pendergrass.*

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VOLUME XXIII JUNE, 1930 NUMBER 6

JUN 23 1930

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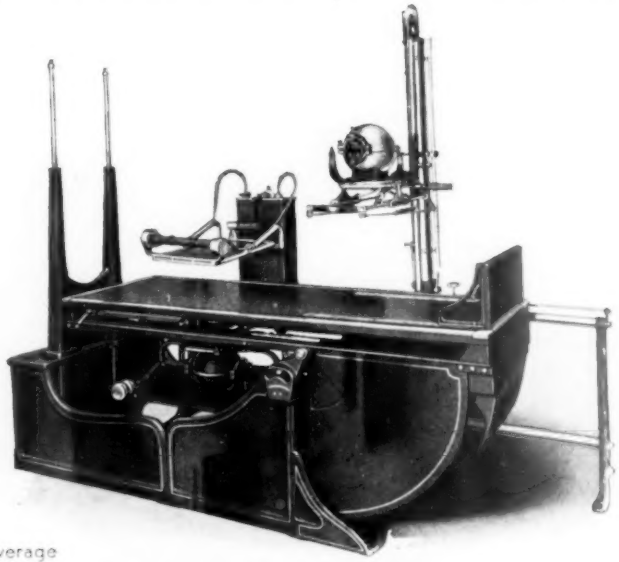

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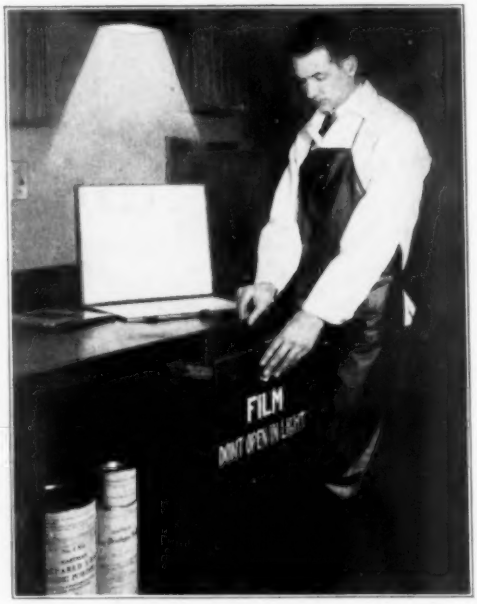

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